

**REPORT
OF
CONSTRUCTION PLANT
AND
MACHINERY COMMITTEE**

1972

VOL. II (APPENDICES)

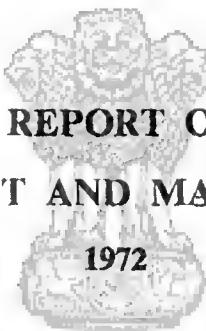


नवागमेव जयते



सत्यमेव जयते

**GOVERNMENT OF INDIA
MINISTRY OF IRRIGATION & POWER
NEW DELHI**



REPORT OF
CONSTRUCTION PLANT AND MACHINERY COMMITTEE
1972
VOL. II (APPENDICES)

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RECOMMENDATIONS OF THE PREVIOUS CONSTRUCTION PLANT AND MACHINERY COMMITTEE

1. Construction plant should be planned and detailed with the same care as is essential for working out other details of a project. It should be based on carefully collected data regarding materials, progress schedules and specifications.
2. Planning should take into account the job set up and should aim at utilising about 75% of the life of the capital equipment against a definite programme for utilisation.
3. The "job factor" and the "management factor" should be properly evaluated in as far as this affects costs and production. The master plan of equipment should bring about all these points and their effects on cost and production.
4. Small sizes of equipment are not recommended for use on projects except in as far as they may be required to aid the manual work.
5. The policy of purchase of capital equipment should be coodinated with the overall plans of the project engineer to fit his organisation and job requirements.
6. For large earth dams, mechanisation is essential for economy and to meet the production targets. Canal excavation has a greater scope for employing manual labour. Judicious use of equipment to assist the manual work is advocated.
7. Yearly financial grants should be arranged in such a way as to avoid piecemeal purchase of equipment causing the introduction of non-standardised equipment.
8. The quotations for the purchase of equipment must be weighed with due regard to services which the firm can offer in ex-stock supply of spares and technical assistance.
9. Multi-shift working should be a standard feature and suitable allowance or extra pay should be given to the project staff for shouldering the additional responsibility of multishift working and cost control.
10. Proper facilities for ancillary services, e. g., flood-light, railroad, labour amenities, transport for supervisory personal, communication, etc., should be incorporated in the plan as the efficiency of the equipment operation will depend upon such services.
11. Careful layout for standardisation of lubricants is recommended. Importance of clean fuel for efficient operation is brought out. Filtered oil can be used for less exacting duties to keep down costs.
12. Incentive wage for production in excess of standards of operation and maintenance should be a regular features of wage structure.
13. Adequate amenities should be offered to the operation and maintenance personnel to enable them to do their duties efficiently and safely, e. g., providing uniforms, warm overalls, goggles, etc.
14. The training programme under consideration by C.W. & P.C. must be implemented as soon as possible under a new Directorate of Technical Man power.
15. Mode of calculation of the working cost of each type of plant per hour; the unit cost of the work performed by each type of plant on the various projects should be computed for the last working season and variations in cost should be explained.
16. Suggestions for a unified scale of depreciation to be followed of all river valley projects.
17. The "plant hour" is defined as "meter hours" where meters are working where such meters do not exist, commensurate effective hours, based on the working of similar other machines with meters, should be used.
18. The expenditure on the purchase of earthmoving machinery should be accounted for as suspense charges and charged off progressively to works through depreciation.
19. A flat rate of levy is proposed for Major Repairs to equipment, which should be credited to a Reserve Fund and the charges for Major Repairs watched through suspense estimates, should be debited to the fund.
20. The operating charges should be watched through suspense estimates and cleared monthly by debit to the work to which services are rendered.
21. The Log Book should be used as a primary record of operational data and the History Books should give all the technical and cost data of a machine for technical and fiscal evaluation.
22. Project should be allowed to order their spare parts requirements either against D.G.S. & D. rate contracts or under normal procedures of tenders. Attention of the Stores Purchase Committee should be drawn to the necessity of obtaining spare parts and other materials expeditiously by the projects by delegating adequate powers to the project officers.
23. Organisation of the store should be such as can render quick service to the project.

24. A Central Organisation under C.W. & P.C. to coordinate the demand for equipment following its release from completed projects is suggested.

25. A Central Sealing Organisation under C.W. & P.C. to assist the projects to forecast their demands of spare parts and to build up stocks of only useful items is suggested.

26. Organisations are suggested to be set up for (i) Machinery Exchange, spare parts coordination and sealing of forward requirements of spares, (ii) Technical Man Power Organisation to pool and utilise the available resources of skilled personnel for effective utilisation on projects and (iii) Cost accounting organisation to assist the projects to utilise modern methods of cost and production control and to act as a watch of the Government of India, working on definite and detailed figures.

APPENDIX 0.2

No. 6(5)/69-Policy/Mat.

GOVERNMENT OF INDIA

Ministry of Irrigation and power

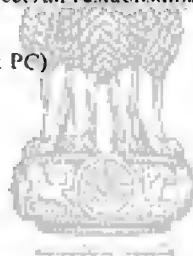
New Delhi, the 31st October, 1970.

MEMORANDUM

Subject: —Appointment of a Committee to report on construction plant and Machinery used in various River Valley Projects in the country.

In October, 1953, the Government of India appointed a committee of engineers to visit some of the projects then under execution, and submit its report on the economic and efficient operation and maintenance of the plant and machinery used in the construction work of River Valley Projects in the country. The Committee submitted its report in February, 1954. Since then, a good deal of equipment has been imported but satisfactory utilisation thereof has been hampered for want of spares etc. It is considered necessary to take stock of the position in regard to the equipment available in the country and its optimum utilisation. The Government of India have, therefore, decided to set up a Committee, with the following composition, for carrying out the study in detail after visits to some of the important projects and establishment(s):—

1.	Shri S.P. Chugh, (at present Director (P & M), CW & PC)	Chairman
2.	Shri Jagman Singh, Superintending Engineer, Mechanical Circle, Beas Project, Unit-II, Talwara.	Member (Part-time)
3.	Shri Gopala Rao, Superintending Engineer, Nagarjunasagar Dam Project Andhra Pradesh.	Member (Part-time)
4.	Shri I.N. Srivastava, Director(D II), CW & PC (WW)	Member (Part-time)
5.	Shri M.C. Praharaj, Deputy Director (P & M), C.W. & P.C. (Water Wing).	Member-Secretary



2. If necessary, the Committee may co-opt members from other interested organisations like National Coal Development Corporation, National Minerals Development Corporation, Hindustan Steel etc. The Committee will be provided necessary supporting staff.

3. The terms of reference of the Committee will be as follows :—

- (i) Appraisal of the Construction Plant and Equipment in the country;
- (ii) Assessment regarding level of utilisation of available equipment;
- (iii) Reasons for low utilisation of equipment and low efficiency in operation;
- (iv) Procedure, System and methods of procurement of spare parts and inventory control;
- (v) Remedial measures necessary for improving efficiency in the operation of equipment and for optimum utilisation thereof;
- (vi) Requirements of equipment in the Fourth Five Year Plan, import substitution and standardisation;
- (vii) Inter-departmental co-ordination in matters relating to Construction Plant and Equipment with emphasis on inter-departmental transfer of surplus equipment;
- (viii) Training of operators and mechanics—Review of adequacy of present arrangements etc.

- (ix) Data on performance of different items of equipment of various categories/makes;
 - (a) Technical assessment;
 - (b) Norms for schedules of working hours and life of equipment of various items;
 - (c) Actual performance of various items of equipment in different projects in various sectors in terms of average annual utilisation and the life usefully spent on different jobs over given periods;
 - (d) Major repairs and field repairs -Charges over the last ten years, in respect of various items of equipment in terms of
 - (1) Spare parts; and
 - (2) Labour,
- (x) Hire Charges of equipment;
- (xi) Maintenance procedures;
- (xii) Organisational set-up, including workshop facilities stores and warehouses etc.;
- (xiii) Organisation and functioning of Central Mechanical Units in Irrigation and Power Sector and similar other establishments in other sectors;
- (xiv) Accounting for the ownership and operating cost per plant hour;
- (xv) Recommendations for management, operation and utilisation of construction plant and equipment.

4. The expenditure on T.A. and D.A. in respect of Saryashri Jagman Singh and Gopala Rao will be met by the Central Water and Power Commission (Water Wing) from out of their budget grant.

5. The Committee will submit its report as early as possible but in any case within a period of one year.



Sd/-A.F. Couto
Director (F.E. & P.)

To

1. Shri S.P. Chugh, Director (P & M), CW & PC (Water Wing), New Delhi.
2. Shri Jagman Singh, Superintending Engineer, Mechanical Circle, Beas Project, Unit-II, Talwara.
3. Shri Gopala Rao, Superintending Engineer, Nagarjunasagar Dam Project, Andhra Pradesh.
4. Shri J.N. Srivastava, Director (D-II) C.W. & P.C. (Water Wing), New Delhi.
5. Shri M.C. Praharaj, Deputy Director (P&M), C.W. & P.C. (Water Wing), New Delhi.
6. The Chairman, Central Water and Power Commission (Water Wing), New Delhi.
7. The Accounts Officer, C.W. & P.C. (Water Wing), New Delhi.
8. The General Manager, Beas Project, Talwara.
9. The Secretary to the Government of Andhra Pradesh, Public Works Department, Projects Wing, Hyderabad-4 with reference to his letter No. 3438-A 1/70-2 dated 21-9-70.
10. The Ministry of Finance (Department of Expenditure, I & P. Branch), New Delhi.
11. U.S. (E), Ministry of Irrigation & Power.
12. Adm.I/Adm. IV Sections, Ministry of I. & P.
13. Budget/Internal Finance Sections, Ministry of Irrigation & power.

Copy also to :-

1. P. S. to Minister for I.&P.
2. P. S. to Deputy Minister for I.&P.
3. P. S. to Secretary, Ministry of I.&P.
4. Editor, Bhagirath.
5. Information Officer, Ministry of Irrigation and Power.

Sd/- A.F. Couto
Director (F.E. & P.)

No. 6(5)/69-Policy/Mat.

GOVERNMENT OF INDIA
Ministry of Irrigation and Power

New Delhi, the 19th January, 1971.

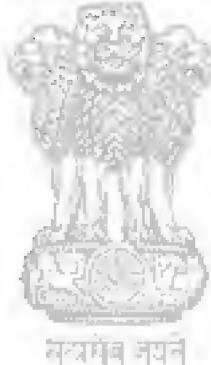
MEMORANDUM

Subject: — Appointment of a Committee to report on Construction Plant and Machinery used in various projects in the country.

The undersigned is directed to refer to this Ministry's Memorandum of even number dated the 31st October, 1970 on the subject mentioned above and to say that it has, now been decided to appoint Shri B. Kotaiah, Superintending Engineer (Mechanical) Public Works Department, Andhra Pradesh, Hyderabad as a Part-time member of the above mentioned Committee in place of Shri Gopala Rao, who is being appointed as Chief Engineer of the Salal H.E. Project.

2. The expenditure on T.A. and D.A. in respect of Shri Kotaiah will be met by the Central Water and Power Commission (Water Wing) from out of their grant.

Sd/- A.F.Couto.
 Director (F. E. & P)



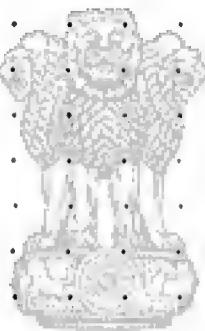
APPENDIX 1.1

STATEMENT SHOWING EQUIPMENT AVAILABLE WITH DIFFERENT SECTORS

(Value in Rs. lakhs)

Sl. No.	Sector	Total No. of machines		Working Condition		Break up of Column 3 & 4 according to condition of machines						Surplus Nos.	
		Total Value of machines	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.		
1	2	3	4	5	6	7	8	9	10	11	12		
1. Central Govt.	• • •	3,788	4,455.72	2,440	3,013.37	971	1,120.69	377	321.66	109	45.52		
2. State Govt. • • •	7,542	13,271.38	4,617	9,397.77	2,016	3,157.07	909	716.54	1,608	1,438.21			
3. Govt. Corporations/Undertakings •	2,897	8,778.73	2,253	7,722.58	522	884.95	122	171.20	368	569.67			
4. Private Bodies • • •	1,438	2,651.79	1,175	2,263.93	218	321.04	45	66.82	56	84.74			
TOTAL		15,665	29,157.62	10,485	22,397.63	3,727	5,483.75	1,453	1,276.22	2,141	2,138.14		

CENSUS OF EQUIPMENT AS SUPPLIED BY THE DEALERS OF EQUIPMENT

S. No.	Category of Equipment	Total Nos.
1.	Excavators & Cranes	1767
2.	Tractors:	
	i) Crawler	5233
	ii) Wheeled	147
3.	Dumpers	3203
4.	Scrapers (Motorised)	966
5.	Motor Graders	288
6.	Front End Loaders:	
	(i) Crawler	113
	(ii) Wheeled	114
7.	Crushing, Screening & Processing Plants	198
8.	Tractor Trailors	43
9.	Mobile Workshops	26
10.	Compressors	3500
11.	Drills/Drilling Equipment	371
12.	Pile Driving Equipment	35
13.	Water Tankers & Sprinklers	3
14.	Fork Lifts	56
15.	Batching & Processing Plants	17
	 नियमित निधन	
	TOTAL	16080

STATEMENT SHOWING THE EQUIPMENT WITH STATE GOVERNMENTS INCLUDING

I. & P. PROJECTS

(Value in Rs. lakhs.)

Sl. No.	Category of Equipment	Total Nos.	Total Value	Break up of Columns 3 & 4 according to condition of machine								Surplus Value	
				Working Condition				Under Repairs					
				Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value		
1	2	3	4	5	6	7	8	9	10	11	12	141.24	
1. Excavators (including Dredgers)	.	408	2,085.06	303	1,652.33	92	404.11	13	28.62	40	141.24		
2. (i) Tractors (C)	.	2,310	3,646.32	1,147	2,349.26	710	1,069.35	453	227.71	635	430.87		
(ii) Tractors (W)	.	303	186.04	148	87.94	101	72.53	54	25.57	129	68.19		
3. Dumpers	.	1,432	3,260.01	875	2,239.87	414	731.50	143	288.64	289	366.50		
4. (i) Scrapers (M)	.	804	1,916.35	468	1,286.77	246	537.71	90	91.87	111	170.7		
(ii) Scrapers (T)	.	222	118.89	155	94.16	24	6.81	43	17.92	78	32.85		
5. Motor Graders	.	211	180.60	107	103.06	68	61.76	36	15.78	51	34.01		
6. (i) Front End Loaders (Crawler)	.	69	102.65	43	58.97	23	40.58	3	2.10	15	20.95		
(ii) Front End Loaders (Wheeled)	.	57	104.35	46	87.88	9	13.25	2	3.22	7	6.27		
7. Cranes (all types)	.	215	652.10	173	587.16	35	62.27	7	2.67	31	46.34		
8. Batching & Mixing Plant	.	8	101.00	7	100.95	1	0.05	..	..	1	0.05	
9. Air Compressors (all types)	.	644	230.27	478	179.93	136	43.42	30	6.62	103	31.56		
10. Drills & Drilling Equipment	.	284	213.92	241	167.90	58	44.02	5	2.00	38	30.45		
11. Crushing, Screening & aggregate Processing Plants	.	250	107.80	207	90.91	40	16.16	3	0.73	9	8.26		
12. Locomotives	.	58	87.55	28	76.61	30	10.94	..	..	31	11.78	
13. Agitating Cars	.	4	5.34	2	2.67	2	2.67	..	..	..	..
14. Cableways	.	4	71.79	4	71.79	..	..	..	..	1	30.00	
15. Belt Conveyors	.	7	5.93	6	5.06	1	0.87	..	..	1	0.87	
16. Tractor Trailers	.	162	81.22	134	70.08	25	10.96	3	0.18	12	4.10		
17. Vibratory rollers	.	23	19.09	11	10.34	12	8.75	..	..	1	0.40	
18. Mobile Workshop	.	10	4.96	8	4.11	..	..	2	0.85	2	0.85	
19. Water tanks & Sprinklers	.	5	14.88	3	7.51	2	7.37	..	..	1	0.14	
20. Muckers & Rocker shovels	.	19	69.02	14	57.77	5	11.25	..	..	..	..
21. Fork lifts	.	6	3.90	5	3.27	1	0.63	..	..	..	..
22. Ditchers, Trenchers	.	23	3.05	1	1.29	..	..	22	1.76	22	1.76	
23. Mine Car Loaders	.	4	0.29	3	0.18	1	0.11	..	..	..	..
Total		7,542	13,271.38	4,617	9,397.77	2,016	3,157.07	909	716.54	1,608	1,438.21		

APPENDIX 1.3.1.

STATEMENT SHOWING STATEWISE CENSUS VALUE OF EQUIPMENT

(Value in Rs. lakhs).

Sl. No.	Category of Equipment	A.P.		Assam		Bihar		Gujarat		Haryana		H.P.	
		Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Excavators (including Dredgers).	54	240.59	8	7.00	28	134.85	19	93.32	30	112.42	23	129.53
2.	(i) Tractors (Cr.)	282	508.50	..	..	97	180.35	196	332.98	57	34.39	45	111.39
	(ii) Tractors (Wh.)	61	16.36	..	..	9	9.23	..	..	13	3.08	..	..
3.	Dumpers	165	239.86	..	..	97	216.32	7.	242.33	7	1.85	95	270.57
4.	(i) Scrapers (M)	191	481.69	..	..	26	70.88	77	309.99	..	..	..	..
	(ii) Scrapers (T)	3	0.89	..	..	9	5.63	11	6.42	..	..	..	..
5.	Motor Graders	23	23.35	9	7.20	7	5.68	14	6.90	10	9.15	1	1.36
6.	(i) Front End Loaders (Cr.)	..	..	..	..	2	2.58	1	0.51	..	..	3	7.25
	(ii) Front End Loaders (Wh.)	11	20.75	..	..	..	..	14	40.49	..	..	13	18.02
7.	Cranes (All Types)	22	31.21	..	..	20	87.33	6	16.65	..	..	1	5.60
8.	Batching and Mixing Plants	1	1.92	..	..	..	..	..	..	..	..	4	90.75
9.	Air Compressors (All Types)	84	31.24	..	..	14	5.71	116	36.09	7	1.68	8	3.71
10.	Drills & Drilling Equipment	45	19.88	..	..	5	16.52	37	15.97	..	..	..	..
11.	Crushing, Screening & Aggregate Processing Plants	7	9.78	26	6.50	..	..	4	1.26	1	0.26	7	1.72
12.	Locomotives	29	11.01	..	..	..	..	2	55.20	..	..	3	0.77
13.	Cable Ways	1	30.00	..	..	..	..	..	..	..	..	..	..
14.	Belt Conveyors	4	5.25	..	..	..	..	..	..	..	..	1	0.40
15.	Tractor Trailers	26	10.97	..	..	1	0.50	7	1.94	9	10.20	..	..
16.	Vibratory Rollers	1	0.40	..	..	..	..	1	0.38	..	..	..	..
17.	Mechers & Rocker Shovels	..	..	..	..	..	..	..	..	..	..	18	67.83
18.	Fork Lifts	..	..	..	..	2	1.26	..	..	..	..	..	..
	Total	1,010	1,683.65	43	20.70	317	73.674	576	1,160.43	134	173.03	222	708.90

Sl. No.	Category of Equipment	J. & K.		Kerala		M.P.		Maharashtra		Mysore		Orissa	
		Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value
1	2	15	16	17	18	19	20	21	22	23	24	25	26
1.	Excavators (including Dredgers)	8	55.16	10	30.98	14	60.30	17	108.56	15	55.30	26	164.64
2.	(i) Tractors (Cr.)	17	40.68	18	20.92	238	245.19	.218	603.88	136	269.99	237	256.61
	(ii) Tractors (Wh.)	..	..	2	0.20	18	11.34	28	5.52	23	13.16	14	16.30
3.	Dumpers	40	55.11	66	56.13	98	164.96	130	309.89	84	186.41	203	503.34
4.	(i) Scrapers (M)	3	6.59	4	7.84	130	202.90	68	170.62	83	239.44	19	16.12
	(ii) Scrapers (T)	2	0.80	2	0.26	25	17.42	8	4.80	1	0.52	20	4.07
5.	Motor Graders	2	2.00	2	0.84	37	28.49	20	31.11	9	12.05	20	15.31
6.	(i) Front End Loaders (Cr.)	1	1.25	..	..	2	2.66	39	50.76	4	4.78	10	23.24
	(ii) Front End Loaders (Wh.)	..	..	5	8.66	..	..	2	0.33	2	2.06	..	..
7.	Cranes (All Types)	2	3.93	28	89.87	8	11.78	20	30.51	13	21.59	12	19.81
8.	Air Compressors (All Types)	13	5.26	30	5.24	4	1.85	74	23.11	38	13.24	11	3.52
9.	Drills & Drilling Equipment	..	..	45	3.82	6	1.33	54	24.94	2	1.35	1	0.29
10.	Crushing, Screening and Aggregate Processing Plants	2	0.36	..	..	..	..	136	45.07	8	2.06	21	10.56
11.	Locomotives	..	..	..	..	..	..	2	2.85	1	0.18	..	..
12.	Cable Ways	..	..	2	8.47	..	..	..	..	..	..	..	..
13.	Belt Conveyors	..	..	..	..	..	..	2	0.28	..	..	..	..
14.	Tractor Trailers	..	..	..	..	6	9.23	..	..	33	12.13	27	1.97
15.	Mobile Workshops	..	..	1	1.00	..	..	..	..	..	..	..	..
16.	Fork Lifts	..	..	..	..	3	1.96	..	..	..	..	..	..
17.	Ditchers/Trenchers	..	..	..	..	1	1.29	..	..	..	..	6	1.20
18.	Mine Car Loaders	..	..	3	0.18	..	..	..	..	1	0.11	..	..
	Total	91	172.14	217	233.41	590	760.70	818	1,442.23	453	834.37	627	1,056.98

APPENDIX 1.3.1—*Contd.*

Sl. No.	Category of Equipment	Punjab		Rajasthan		Tamil Nadu		U.P.		West Bengal		Total of all States	
		Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value
1	2	27	28	29	30	31	32	33	34	35	36	37	38
1.	Excavators (including Dredgers)	79	459.66	23	163.16	3	6.63	34	214.22	17	48.74	408	2,085.06
2.	(i) Tractors (Cr.)	116	208.52	314	176.24	30	57.02	255	514.62	54	54.94	2,310	3,646.32
	(ii) Tractors (Wh.)	4	15.86	45	5.88	..	..	57	61.86	19	27.25	303	186.04
3.	Dumpers	179	571.38	2	0.13	31	15.03	144	407.43	20	19.27	1,432	3,260.01
4.	(i) Scrapers (M)	3	1.93	8	15.06	40	86.42	112	188.05	40	118.82	804	,916.35
	(ii) Scrapers (T)	..	..	119	69.82	..	..	16	7.37	6	0.89	222	118.89
5.	Motor Graders	12	10.19	20	6.03	..	..	18	16.00	7	5.04	211	180.60
6.	(i) Front End Loaders (Cr.)	..	..	3	5.34	..	..	..	..	4	3.28	69	102.65
	(ii) Front End Loaders (Wh.)	2	3.58	..	..	..	..	6	9.22	2	1.24	57	104.35
7.	Cranes (All Types)	10	17.35	6	4.53	25	81.22	34	146.81	8	83.91	215	652.10
													12,252.37
8.	Batching and Mixing Plants	3	8.33	..	..	..	..	..	..	..	..	8	101.00
9.	Air Compressors (All Types)	22	16.08	23	11.90	25	6.89	123	49.75	52	15.00	644	230.27
10.	Drills & Drilling Equipment	17	5.35	..	..	..	..	71	124.27	1	0.20	284	213.92
11.	Crushing, Screening and Aggregate Processing Plants	3	20.21	1	0.15	31	9.37	2	0.40	1	0.10	250	107.80
12.	Locomotives	1	0.17	..	..	17	16.74	..	..	3	0.63	58	87.55
13.	Agitating Cars	..	..	..	..	..	..	4	5.34	..	..	4	5.34
14.	Cable Ways	1	33.32	..	..	..	..	..	..	..	..	4	71.79
15.	Belt Conveyors	..	..	..	..	..	..	..	..	..	..	7	5.93
16.	Tractors Trailors	3	6.18	31	7.66	7	7.49	12	12.95	..	..	162	81.22
17.	Vibratory Rollers	..	..	..	..	..	..	18	17.41	3	0.90	23	19.09
18.	Mobile Workshops	..	..	8	2.76	..	..	1	1.20	..	..	10	4.96
19.	Water Tankers and Sprinklers	..	..	..	..	..	..	5	14.88	..	..	5	14.88
20.	Muckers & Rocker Shovels	1	1.19	..	..	..	..	..	..	..	..	19	69.02
21.	Fork Lifts	..	..	16	0.56	..	..	1	0.68	..	..	6	3.90
22.	Ditchers/Trenchers	..	..	..	..	..	..	..	..	..	..	23	3.05
23.	Mine Car Loaders	..	..	..	..	..	..	..	..	..	..	4	0.29
	TOTAL	456	1,379.40	619	469.22	209	286.81	923	1,792.46	237	380.21	7,542	13,271.38

APPENDIX 1.4

STATEMENT SHOWING EQUIPMENT WITH CENTRAL GOVT. DEPARTMENTS INCLUDING I & P. PROJECTS

(Value in Rs. Lakhs)

S. No.	Category of Equipment	Total Nos.	Total Value	Break up of Columns 3 & 4 according to condition of machines							
				Working Condition				Under Repairs		Beyond Economical Repairs	
				Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value
1	2	3	4	5	6	7	8	9	10	11	12
1.	Excavators (including Dredgers)	.	.	123	370.56	111	343.41	10	24.86	2	2.29
2.	(i) Tractors (Cr.)	.	.	1,405	2,201.15	765	1,375.00	375	554.13	265	272.02
	(ii) Tractors (Wh.)	.	.	192	87.17	180	73.86	9	9.98	3	3.33
3.	Dumpers	.	.	48	53.56	11	10.05	32	43.32	5	0.19
4.	(i) Scrapers (M)	.	.	106	259.61	96	221.84	9	17.60	1	0.17
	(ii) Scrapers (T)	.	.	34	42.84	33	42.72	1	0.12	..	..
5.	Motor Graders	.	.	125	117.50	86	82.18	30	26.21	9	9.11
6.	Front End-Loaders (Wh.)	.	.	32	24.10	6	4.89	23	16.99	3	2.22
7.	Cranes (All Types)	.	.	90	223.52	83	214.34	6	9.16	1	0.02
8.	Air Compressors (All Types)	.	.	897	570.68	499	186.18	317	354.93	81	29.57
9.	Drills & Drilling Equipment	.	.	24	10.32	24	10.32	..	..	2.22	2
10.	Crushing Screening & Aggregate Processing Plants	.	.	448	188.32	312	135.35	130	50.40	6	2.57
11.	Belt Conveyors	.	.	60	9.69	56	8.91	4	0.78	..	..
12.	Tractor Trailors	.	.	31	37.50	29	35.39	2	2.11	..	..
13.	Vibratory Rollers	.	.	5	0.80	1	0.17	3	0.46	1	0.17
14.	Mobile Workshops	.	.	7	9.72	6	9.42	1	0.30	..	..
15.	Water Tankers and Sprinklers	.	.	20	0.97	20	0.97	..	..	1	0.30
16.	Pile Driving Equipment (including Vibrosinkers)	.	.	53	55.19	39	49.31	14	5.88	..	..
17.	Tugs & Barges	.	.	63	191.10	63	191.10	..	..	..	..
18.	Asphalt Distributors & Paver Finisher	.	.	25	21.42	20	17.96	5	3.46	..	..
	Total			3788	4455.72	2440	3013.37	971	1220.69	377	321.66
										109	45.52

STATEMENT SHOWING THE EQUIPMENT WITH GOVT. CORPORATIONS/UNDERTAKINGS

APPENDIX 1.5

(Value in Rs. lakhs)

S.No.	Category of Equipment	Total Nos.	Total Value	Break up of Columns 3 & 4 according to condition of machines							
				Working Condition		Under Repairs		Beyond Economical Repairs		Surplus	
				Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value
1	2	3	4	5	6	7	8	9	10	11	12
1.	Excavators (including Dredgers)	.	.	202	3,023.14	176	2,868.76	20	135.43	6	18.95
2.	(i) Tractors (Cr.)	.	.	559	1,024.53	388	773.53	156	221.31	15	29.69
	(ii) Tractors (Wh.)	.	.	162	70.07	106	45.85	47	21.01	9	3.21
3.	Dumpers	.	.	639	2,020.44	506	1,787.02	106	183.79	27	49.63
4.	(i) Scrapers (M)	.	.	46	137.20	15	45.14	31	92.06	..	..
	(ii) Scrapers (T)	.	.	8	6.52	7	6.10	1	0.42	..	..
5.	Motor Graders	.	.	27	31.73	18	25.82	8	5.34	1	0.57
6.	(i) Front End Loaders (Cr.)	.	.	18	32.24	7	9.30	10	21.55	1	1.39
	(ii) Front End Loaders (Wh.)	.	.	27	53.81	15	29.09	4	11.92	8	12.80
7.	Cranes (All Types)	.	.	446	1,383.54	67	1,243.85	70	120.35	10	19.34
8.	Batching & Mixing Plants	.	.	1	2.00	1	2.00	..	..	..	..
9.	Air Compressors (All Types)	.	.	297	137.61	235	112.86	41	18.60	21	5.88
	Drills & Drilling Equipment	.	.	189	422.09	180	404.93	5	1.91	4	15.25
11.	Crushing, Screening and Aggregate processing Plants	.	.	9	46.40	5	13.87	4	32.53	..	..
12.	Locomotives	.	.	40	115.67	35	98.87	4	11.80	1	5.00
13.	Belt Conveyors	.	.	20	99.15	20	99.15	..	..	..	..
14.	Tractor Trailers	.	.	100	29.47	93	28.28	7	1.19	..	..
15.	Fork Lifts	.	.	103	41.78	76	26.82	8	5.74	19	9.22
16.	Ditchers/Trenchers	.	.	1	1.00	1	1.00	..	..	..	..
17.	Spreaders	.	.	3	100.34	3	100.34	..	..	..	..
	Total	.	2,897	8,778.73	2,253	7,722.58	522	884.95	122	171.20	368
											569.67

STATEMENT SHOWING THE EQUIPMENT WITH PRIVATE BODIES

(Value in Rs. Lakhs)

S. No.	Category of Equipment	Total Nos.	Total Value	Break up of Columns 3 & 4 according to condition of machines								Surplus	
				Working Condition		Under Repairs		Beyond Economical Repairs		Surplus			
				Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value		
1	2	3	4	5	6	7	8	9	10	11	12		
1.	Excavators (including Dredgers)	.	.	110	605.06	102	583.18	8	21.88	..	..	3 2.75
2.	(i) Tractors (Cr.)	.	.	134	295.84	95	213.73	37	78.89	2	3.22	9 9.70	
	(ii) Tractors (Wh.)	.	.	37	19.59	32	18.35	5	1.24	..	..	.. ..
3.	Dumpers.	.	.	370	596.49	298	518.16	53	56.11	19	23.22	22 29.29	
4.	(i) Scrapers (M)	.	.	41	117.63	27	71.81	4	12.42	10	33.40	.. ..
	(ii) Scrapers (T)	.	.	30	62.10	13	26.91	17	35.19	..	..	.. ..
5.	Motor Graders	.	.	10	6.41	8	4.81	2	1.60	..	..	.. ..
6.	(i) Front End Loaders (Cr.)	.	.	43	81.01	34	67.78	8	11.94	1	1.29	4 3.82	
	(ii) Front End Loaders (Wh.)	.	.	66	140.43	53	117.48	11	20.05	2	2.90	.. ..
7.	Cranes (All Types)	.	.	108	274.55	84	214.51	24	59.87	..	..	8 37.27
8.	Batching and Mixing Plants	.	.	7	43.67	7	43.67	..	..	..	..	.. ..
9.	Air Compressors (All Types)	.	.	201	96.65	171	86.87	24	8.94	6	1.84	2 0.52	
10.	Drills & Drilling Equipment	.	.	84	85.27	69	80.24	11	4.11	4	0.92	2 0.27	
11.	Crushing, Screening and Aggregate Processing Plants	.	.	56	80.72	50	79.70	5	0.99	1	0.03	5 0.99	
12.	Locomotives	.	.	33	37.87	32	37.20	1	0.67	..	..	.. ..
13.	Belt Conveyors	.	.	15	12.30	15	12.30	..	..	..	..	.. ..
14.	Tractor Trailors	.	.	67	41.10	64	40.66	3	0.44	..	..	1 0.13
15.	Muckers/Rocker Shovels	.	.	6	19.46	6	19.46	..	..	..	..	.. ..
16.	Fork Lifts	.	.	17	16.41	14	13.71	3	2.70	..	..	.. ..
17.	Ditchers/Trenchers	.	.	2	4.00	..	..	2	4.00	..	..	.. ..
18.	Ore Loading Plants	.	.	1	14.40	1	14.40	..	..	..	..	.. ..
	Total			1,438	2,651.79	1,175	2,263.93	218	321.04	45	66.82	56 84.74	

STATEMENT SHOWING CATEGORY-WISE EQUIPMENT IN IRRIGATION & POWER SECTOR

(Value in Rs. lakhs)

S. No.	Category of Equipment	Total Nos.	Total Value	Break up of Columns 3 & 4 according to condition of Machines								Surplus	
				Working condition		Under Repairs		Beyond Economical Repairs		Nos.			
				Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value		
1	2	3	4	5	6	7	8	9	10	11	12	14	
1.	Excavators (Including Dredgers)	.	.	461	2,267.53	339	1,759.87	107	477.95	15	29.71	52	167.33
2.	(i) Tractors (Cr.)	.	.	2,337	3,833.47	1,125	2,469.51	914	1,208.98	298	154.98	666	472.20
	(ii) Tractors (Wh.)	.	.	276	170.28	112	89.74	123	58.43	41	22.11	133	44.08
3.	Dumpers.	.	.	1,500	3,354.03	883	2,253.37	473	817.16	144	285.50	299	364.04
4.	(i) Scrapers (M)	.	.	822	1,964.78	476	1,319.49	251	555.594	95	89.35	125	163.83
	(ii) Scrapers (T)	.	.	214	116.85	151	95.41	29	9.15	34	12.29	63	22.26
5.	Motors Graders	.	.	205	181.65	106	109.12	74	58.19	25	14.34	47	28.10
6.	(i) Front End Loaders (Cr.)	.	.	68	95.49	43	57.14	21	36.25	4	2.10	13	23.34
	(ii) Front End Loaders (Wh.)	.	.	43	68.47	34	54.75	8	12.11	1	1.61	2	3.11
7.	Cranes (All Types)	.	.	23	805.07	191	747.05	33	56.61	7	1.41	23	27.66
8.	Batching & Mixing Plants	.	.	7	100.95	7	100.95	..	..	..	..	..	..
9.	Air Compressors (All Types)	.	.	544	209.07	388	159.45	127	42.31	29	7.31	82	36.30
10.	Drills & Drilling Equipment	.	.	234	208.44	192	163.10	37	43.34	5	2.00	34	29.29
11.	Crushing, Screening, & Processing Plants	.	.	100	55.46	80	43.26	18	11.80	2	0.40	9	7.98
12.	Locomotives	.	.	56	32.35	49	31.46	7	0.89	..	..	7	1.14
13.	Agitating Cars	.	.	4	5.33	2	2.67	2	2.66	..	..	..	..
14.	Cable Ways	.	.	4	71.78	4	71.78	..	..	..	..	..	..
15.	Belt Conveyors	.	.	7	5.92	6	4.07	1	1.85	..	..	1	185
16.	Tractor Trailers	.	.	156	91.88	139	81.71	14	10.00	3	0.17	11	3.03
17.	Vibratory Rollers	.	.	23	19.09	11	10.34	12	8.75	..	..	1	0.40
18.	Mobile Workshops	.	.	10	4.96	8	4.11	..	..	2	0.85	2	0.85
19.	Water Tankers & Sprinkler	.	.	25	15.84	23	8.48	2	7.36	..	..	1	0.14
20.	Muckers and Rocker Shovels	.	.	17	69.10	12	57.85	5	11.25	..	..	..	..
21.	Fork Lifts	.	.	6	3.90	5	3.27	1	0.63	..	..	..	..
22.	Ditchers/Trenchers	.	.	23	3.05	1	1.29	..	..	22	1.76	22	1.76
23.	Mine Car Loaders	.	.	4	0.48	3	0.18	1	0.30	..	..	1	0.30
24.	Pile Driving Equipment	.	.	48	52.03	34	46.15	14	5.88	..	..	..	..
25.	Tugs & Barges	.	.	49	117.60	49	117.60	..	..	..	..	..	..
	Total	7,474	3,924.85	4,473	9,863.17	2,274	3,437.79	727	623.89	1,594	1,398.99		

CENSUS/VALUE OF INDIGENOUS ITEM OF EQUIPMENT

(Value in Rs. lakhs)

S. No.	Category of Equipment	Central Government			State Governments			Government Corporations; Undertakings			Private Bodies			Total
		Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	
1	2	3	4	5	6	7	8	9	10	11	12			
1.	Excavators (including Dredgers)	.	.	12	70.86	134	976.18	40	314.12	45	342.27	231	1,703.43	
2.	(i) Tractors (Cr.)	.	.	472	618.98	194	601.68	82	845.52	10	35.14	757	1497.75	
	(ii) Tractors (Wh.)	.	.	80	11.00	85	39.14	26	6.68	13	5.67	204	62.49	
3.	Dumpers	.	.	.	.	114	375.77	69	147.63	49	62.59	232	585.99	
4.	(i) Scrapers (M)	.	.	.	.	112	595.16	.	.	.	.	112	595.16	
	(ii) Scrapers (T)	.	.	10	12.21	34	49.43	2	1.85	.	.	46	63.49	
5.	Motor Graders	.	.	1	2.75	13	29.13	4	10.68	.	.	18	42.56	
6.	Front End Loaders (Cr.)	.	.	.	.	9	18.17	.	.	.	.	9	18.17	
7.	Cranes (All Types)	.	.	13	43.80	54	135.26	67	328.60	48	134.00	179	689.22	
8.	Air Compressors (All Types)	.	.	897	570.69	508	197.97	155	77.55	157	79.47	1,712	922.94	
9.	Drills & Drilling Equipment	.	.	13	7.42	204	130.79	141	254.96	58	54.95	416	448.12	
10.	Crushing, Screening and Aggregate Processing Plants	.	.	448	192.53	219	73.58	1	0.18	55	28.01	723	294.30	
11.	Locomotives	.	.	.	.	5	3.62	2	15.31	.	.	7	18.93	
12.	Belt Conveyors	.	.	.	.	7	5.92	18	98.35	6	1.50	31	105.77	
13.	Tractor Trailors	.	.	16	5.95	20	10.99	43	7.66	35	29.94	114	54.54	
14.	Vibratory Rollers	.	.	1	0.12	7	3.52	.	.	.	.	8	3.64	
15.	Mobile Workshops	.	.	6	9.42	.	.	.	.	.	.	6	9.42	
16.	Fork Lifts	.	.	.	.	.	.	23	5.77	5	5.32	28	11.09	
17.	Pipe Driving Equipment (including Vibroshakers)	.	4	2.78	.	.	.	.	.	.	.	4	2.78	
18.	Tugs and Barges	.	63	191.10	.	.	.	.	.	.	.	63	191.10	
	TOTAL		2,036	1,739.61	1,720	3,246.86	671	1,444.56	479	778.86	4,900	8,370.89		

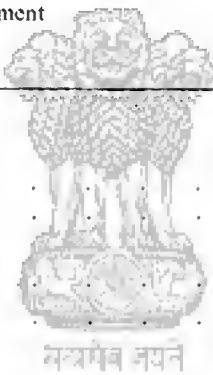
INDIGENOUS MANUFACTURERS OF MAJOR CATEGORIES OF EQUIPMENT

S. No.	Item of Equipment	Name of Manufacturers
1	2	3
1.	Excavators	(i) Tata Engineering & Locomotives, Jamshedpur. (ii) Hindustan Motors, Calcutta. (iii) Heavy Engineering Corporation, Ranchi.
2.	Dumpers	(i) Bharat Earth Movers Ltd., Bangalore. (ii) Hindustan Motors, Madras. (iii) Ashok Leyland, Madras. (iv) Tata Engineering & Locomotives, Co., Jamshedpur.
3.	Tractors (Crawler)	(i) Bharat Earth Movers Ltd., Bangalore. (ii) Hindustan Motors, Madras.
4.	Tractors (Wheeled)	(i) Bharat Earth Movers, Ltd., Bangalore. (ii) Hindustan Motors, Madras. (iii) Escorts, Ltd., Faridabad. (iv) Eicher Tractors India, Ltd., Faridabad. (v) M/s. Hindustan Tractors Ltd., Bombay. (vi) International Tractors Co., Bombay.
5.	Scrapers (Motorised)	(i) Bharat Earth Movers, Ltd., Bangalore.
6.	Scrapers (Towed)	(i) Construction Equipment Co. Pvt. Ltd., Baroda. (ii) Hindustan Motors, Calcutta.
7.	Loaders	(i) Bharat Earth Movers Ltd., Bangalore. (ii) Hindustan Motors, Madras.
8.	Motor Graders	(i) Bharat Earth Movers Ltd., Bangalore.
9.	Cranes (Mobiles)	(i) Coles Crane of India, West Bengal. (ii) Kumardhobi Engineering Works, Calcutta.
10.	Air Compressors 100 cm. & above	(i) M/s. Ingersoll Rand (I) Pvt. Ltd., Bombay. (ii) M/s. Garden Reach Workshops, Calcutta. (iii) M/s. Consolidated Pneumatic Tools Co., (India) Pvt. Ltd., Bombay. (iv) M/s. S.L.M. Maneklal Industries Ltd., Ahmedabad. (v) M/s. Holman Climax Mfg. (P) Ltd., Calcutta. (vi) M/s. Kirloskar Pneumatic Co. Ltd., Poona. (vii) M/s. Atlas Corpo. India (P) Ltd., Bombay. (viii) M/s. K.G. Khosla & Co., (P) Ltd., Delhi.
11.	Dredgers	(i) M/s. Garden Reach Workshop Calcutta. (ii) M/s. Alcock Ashdown, Bombay. (iii) M/s. Mazagon Dock Pvt. Ltd., Bombay. (iv) M/s. Port Engineering Works, Calcutta. (v) M/s. Shalimar Works, Howrah. (vi) M/s. Shaperia Dock & Steel Co., Bombay.
12.	Drills and Drilling Equipment	(i) M/s. Christian Longyear (I) Pvt. Ltd., Bombay. (ii) M/s. Killick Nixon Co., Ltd., Bombay. (iii) M/s. Voltas Ltd., Bombay. (iv) M/s. Heavy Engineering Corporation, Ranchi. (v) M/s. Reliable Water Supply Service of India, Lucknow. (vi) M/s. Atlas Copco, Poona. (vii) M/s. Consolidated Pneumatic Tools Co. (India) Pvt. Ltd., Bombay. (viii) M/s. Holman Climax (P) Ltd., Calcutta. (ix) M/s. Ingersoll Rand India (P) Ltd., Poona. (x) M/s. Kirloskar Pneumatic Co. Poona. (xi) M/s. Revati Machine Tools, Coimbatore.

1	2	3
13. Road Rollers	(i) M/s. Jeessop & Co., Calcutta. (ii) M/s. Britannia Engg. Co., Calcutta. (iii) M/s. Garlick & Co., Calcutta. (iv) M/s. Garden Reach Workshops, Calcutta. (v) M/s. Kamani Engg. Corporation, Bombay.	
14. Diesel Engines 50.H.P. and above	(i) M/s. Kirloskar Oil Engines Ltd., Poona. (ii) M/s. Ruston & Hornsby (I) Ltd., Poona. (iii) M/s. Premier Automobiles Ltd., Bombay. (iv) M/s. Kirloskar Cummins, Poona. (v) M/s. Simson & Co., Madras. (vi) M/s. Ashok Leyland, Madras. (vii) M/s. Tata Engg. & Locomotives, Jamshedpur. (viii) M/s. S.L.M. Maneklal Industries Ltd., Ahmedabad. (ix) M/s. Alcock Ashdown & Co. Ltd., Bombay. (x) M/s. Lynx Machine Ltd., Calcutta. (xi) M/s. Garden Reach Workshop, Calcutta.	

APPENDIX-1.10

FUTURE PROGRAMME OF MANUFACTURE OF HEAVY EARTHMOVING EQUIPMENT

Name of the Firm/Description of Equipment		1972—73		1973—74	
		Nos.	Nos.	Nos.	Nos.
I. M/s. BHARAT EARTH MOVERS LTD.					
1. Crawler Tractors					
(a) D-50		300	300		
(b) D-80		200	200		
(c) D-120 A-18		120	120		
2. Motor Grader		35	35		
3. Motorised Scrapers		40	40		
4. Haulpak Dumpers					
(a) LW-25		50	50		
(b) LW-35		150	150		
(c) LW-50		20	22		
5. Front-end Loaders TIGAR		50	50		
II. M/s. HINDUSTAN MOTORS LTD.					
1. Terec Equipment					
(a) Dumpers 25-T payload capacity		100	100		
(b) Crawler Tractors Model 82-40 . . . . .		..	25		
(c) Front-end Loaders wheeled 2½ cu. yd. cap.		20	30		
2. Hind Marion Excavators, 2.5 to 4 cu. yd. cap		30	30		
III. M/s. ASHOK LEYLAND					
<i>Dumpers — (OFF-The-Highway)</i>					
(a) Hippo 15-T Capacity		70	70		
(b) Beaver 12-T. Capacity		40	40		
IV. M/s. TELCO, JAMSHEDPUR.					
Excavators, 1½ to 4 cu. yd. capacity		60	60		
V. M/s. HEAVY ENGINEERING CORPN.					
Excavators 6 cu. yd. capacity		10	15		

YEARWISE CENSUS/VALUE OF EQUIPMENT

Year	Central Govt. Departments		State Govt. Departments/ Projects		Govt. Undertakings and Corporations		Private Bodies		Total	
	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value
1	2	3	4	5	6	7	8	9	10	11
1971 (part)	30	120.00	31	47.07	20	60.39	8	22.10	89	249.56
1970	21	46.81	273	898.60	287	990.70	62	169.77	643	2105.78
1969	163	447.92	421	1724.49	205	861.62	151	279.89	940	3313.92
1968	233	435.41	468	1577.95	126	230.95	90	179.03	917	2423.34
1967	226	45.58	513	1382.44	171	993.62	156	409.78	1066	3236.42
1966	264	224.89	629	1223.32	256	719.03	183	383.31	1332	2550.55
1965	952	1090.98	820	1579.63	257	862.36	170	337.55	2197	3870.52
1964	308	189.22	665	1426.72	193	385.70	134	183.59	1300	2185.23
1963	496	502.43	521	802.06	239	778.37	52	124.48	1308	2207.34
1962	312	249.06	388	383.71	179	437.22	48	46.66	927	1117.19
1961	285	215.82	429	370.03	72	155.23	121	207.22	907	948.30
1960	307	278.63	445	276.58	98	577.56	84	70.77	934	1203.52
1959	135	156.79	203	138.18	255	684.82	32	41.79	625	1021.56
1958	7	3.73	321	257.38	177	463.08	43	59.68	548	783.87
1957	3	1.24	252	277.37	123	253.00	38	39.40	416	571.01
1956	28	27.53	238	284.53	142	212.50	13	39.19	421	563.75
1955	11	5.92	208	133.47	6	2.59	13	19.65	238	161.63
1954	1	2.33	105	80.69	2	1.63	12	11.84	120	96.39
1953	..	..	165	153.02	40	43.63	8	16.32	213	212.97
1952	..	..	60	52.52	3	4.47	3	3.98	66	60.97
1951	2	2.10	72	22.73	1	0.50	1	0.80	76	26.13
1950	1	0.60	90	40.46	2	0.49	2	0.50	95	42.05
1949	2	2.29	64	35.24	1	0.15	3	1.57	70	39.25
1948	1	1.00	30	8.78	..	..	4	1.90	35	11.68
1947	..	..	7	1.27	14	23.69	2	0.32	23	25.28
1946	..	..	16	3.93	1	0.16	1	0.12	18	4.21
1945	..	..	2	0.40	..	..	..	..	2	0.40
1940	..	..	2	0.74	..	..	..	..	2	0.74
1937	..	..	..	..	..	..	4	0.58	4	0.58
1936	..	..	..	..	2	0.27	..	..	2	0.27
1935	..	..	..	..	5	5.00	..	..	5	5.00
1934	..	..	..	..	2	0.27	..	..	2	0.27
1933	..	..	..	..	4	4.00	..	..	4	4.00
1924	..	..	..	..	2	0.25	..	..	2	0.25
1913	..	..	..	..	1	1.25	..	..	1	1.26
Not indicated	..	..	104	88.07	11	24.35	..	..	115	112.42
Total	3788	4455.72	7542	13271.38	2897	8778.73	1438	2651.79	15665	29157.62

APPENDIX 1.12

STATEMENT SHOWING CATEGORY-WISE POPULATION & VALUE OF EQUIPMENT IN THE COUNTRY

(Value in Rs. Lakhs)

Sl. No	Category of Equipment	Total Nos.	Total Value	Break up of Column 3 & 4 according to condition of machines								Surplus Nos.	Value		
				Working condition				Under Repairs							
				Nos.	Value	Nos.	Value	Nos.	Value	Nos.	Value				
1	2	3	4	5	6	7	8	9	10	11	12				
1.	Excavators (including Dredgers)	843	6,083.82	692	5,447.68	130	586.28	21	49.86	63	198.47				
2. (i)	Tractors (Cr.)	4,408	7,167.84	2,395	4,711.52	1,278	1,923.68	735	532.64	686	550.93				
(ii)	Tractors (Wh.)	694	362.87	466	226.00	162	104.76	66	32.11	184	93.39				
3.	Dumpers.	2,489	5,931.50	1,690	4,555.10	605	1,014.72	194	361.68	369	445.27				
4. (i)	Scrapers (M.)	997	2,410.79	606	1,625.56	290	659.79	101	125.44	149	274.99				
(ii)	Scrapers (Towed)	294	230.35	208	169.89	43	42.54	43	17.92	78	32.85				
5.	Motor Graders	373	336.24	219	215.87	108	94.91	46	25.46	60	40.56				
6. (i)	Front End Loaders (Cr.)	130	214.90	84	136.05	41	74.07	5	4.78	25	21.30				
(ii)	Front End Loaders (Wh.)	182	322.69	120	239.34	47	62.21	15	21.14	17	21.78				
7.	Cranes (All Types)	859	2,533.54	706	2,259.86	135	251.65	18	22.03	129	233.11				
8.	Batching and Mixing Plants	16	146.67	15	146.62	1	0.05	..	..	1	0.05		
9.	Air Compressors (All Types)	2,039	1,035.21	1,383	564.84	518	425.89	138	44.48	222	71.23				
10.	Drills and Drilling Equipment	581	731.60	514	663.39	54	50.04	13	18.17	45	46.47				
11.	Crushing, Screening & Aggregate Processing Plants	763	423.24	574	349.83	179	100.08	10	3.33	17	36.78				
12.	Locomotives	131	241.09	95	212.68	35	23.41	1	5.00	33	15.78				
13.	Agitating Cars	4	5.34	2	2.67	2	2.67	..	..	..	..
14.	Cable Ways	4	71.79	4	71.79	..	..	..	..	1	30.00		
15.	Belt Conveyors	102	127.07	97	125.42	5	1.65	..	..	1	0.87		

	1	2	3	4	5	6	7	8	9	10	11	12			
16.	Tractor Trailers	.	.	.	.	360	189.29	320	174.41	37	14.70	3	0.18	24	5.86
17.	Vibratory Rollers	.	.	.	.	28	19.89	12	10.51	15	9.21	1	0.17	1	0.40
18.	Mobile Workshops	.	.	.	.	17	14.68	14	13.53	1	0.30	2	0.85	3	1.15
19.	Water Tankers and Sprinklers	.	.	.	.	5	15.85	23	8.48	2	7.37	..	..	1	0.14
20.	Muckers/Rocker Shovels	.	.	.	.	25	88.48	21	77.23	5	11.25	..	..	..	..
21.	Fork Lifts	.	.	.	.	126	62.09	95	43.80	12	9.07	19	9.22	10	5.00
22.	Ditchers/Trenchers	.	.	.	.	26	8.05	2	2.29	2	4.00	22	1.76	22	1.76
23.	Mine Car Loaders	.	.	.	.	4	0.29	3	0.18	1	0.11	..	..	..	..
24.	Pile Driving Equipment (including Vibrosinkers)	.	.	.	.	53	55.19	39	49.31	14	5.88	..	..	..	..
25.	Tugs and Barges	.	.	.	.	63	19.10	63	19.10	..	..	..	..	..	..
26.	Ore Loading Plants	.	.	.	.	1	14.40	1	14.40	..	..	..	..	..	..
27.	Asphalt Distributors and Pavers Finishers	.	.	.	.	25	21.42	20	17.96	5	3.46	..	..	..	..
28.	Spreaders	.	.	.	.	3	100.34	3	100.34	..	..	..	..	..	..
	TOTAL	15,665	29,157.62	10,485	22,397.65	3,727	5,4838.75	1,453	1,276.22	2,141	2,138.14				

APPENDIX 2.1

AVERAGE UTILISATION OF MAJOR CATEGORIES OF EQUIPMENT FROM THE DATE OF INITIAL COMMISSIONING TO END OF 1970 AND DURING THE LAST FIVE YEARS IN RESPECT OF SELECTED PROJECTS/DEPARTMENTS IN DIFFERENT SECTORS

(Figures indicate percentage efficiency)

THE ECONOMIC POLICY OF THE REPUBLIC OF KOREA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Jammu & Kashmir																
13. J. & K. Flood Control	.	35	41	80	22	25.9	35	14	20	31	21	16	62	6	7.5	11
Kerala		15	17.5	50	14	12	33	3	3	8	..	..	..	6	6	10
14. Idikki
Madhya Pradesh		4.7	..	16	17	20	35	8	11	19	14	18	31	1.1	5.4	3
15. Tawa
Maharashtra	
16. Mula	.	28	28	55	32	32	55	32	32	59	40	43	74	23.6	23.6	32.5
17. Jayakwadi	.	15	15	24	29	29	72	..	..	39	39	90	..	..	..	..
18. Koyna Hydel	25	17	115	..	..	..	..	..
Mysore	
19. Ghataprabha	13.4	18.4	..	..	..	..	..	..	..	31.7	50.7	..	14
Orissa	
20. Balimela	.	22.2	22.6	71	..	..	..	..	..	..	..	..	..	..	..	..
Punjab	
*21. Beas Unit II	.	75	67.7	144	100	101	122	80	79	111	..	..	..	..	..	..
Rajasthan	
22. Rajasthan Canal	.	43	52	53	53	66	82	..	..	..	..	24	21.7	38	..	..
Tamil Nadu		17.2	..	18.5	33.1	64	..	..	..	20	40	40	..	..
23. Perambikulam Aliyar
Uttar Pradesh	
24. Yamuna	.	13	30.3	28	21.1	30	35	14	28.4	20	..	..	..	4.4	4.4	13
25. Ranganga	.	35	36.2	151	37	39	73	23	24	76	9	18.1	15	12	17	43
West Bengal	
26. Kangsabati	.	8	6	28	13	18	36	1.8	2.8	2.1	46	51	112	4	12	12

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
Central Government																		
27. Rehabilitation Reclamation	56	58	111	..	..	..	..	..	..	..	..	..
28. Rajasthan Atomic	43	..	43	78		
29. Madras Atomic	14	14	24		
Government Corporations/Undertakings																		
30. Neyveli Lignite	62	65	79	94	94	120	74	74	98	..	..	122	106	190	
31. H.S.L. Bhilai	17	4	33.3	8	16	24	13.5	13.2	20	4	19	11	17	33	54
32. H.S.L. Rourkela	101	103	228	7	63.4	11	..	..	49	52	128	
33. H.S.L. Barsua Mines	56	60	74	13.4	42	23.3	37	61.4	44	..	..	..	..	..
34. N.M.D.C. (Bailadila)	41	41	99	60	74	122	51	51	64	..	..	..	..	..
35. N.M.D.C. (Kiriburu)	45	88	..	30	43	..	37	48	..	..	..	..	..	..
36. N.M.D.C. (Donamalai)	57	57	..	75	75	..	..	..	..	..	..	..	..	..
37. N.C.D.C.	100	147	..	75	100	..	50	157	..	..	..	67	90		
38. N.P.C.C.	28	34.2	43.2	11.7	22.7	31.1	11.3	18	20	..	18.4	..	..	..
Private Bodies																		
39. Tata Iron & Steel Co.	120	121	144	118	104	150	120	123	152	100	100	100	
40. Hindustan Const. Co.	36	..	116	54	54	82	33	33	74	51	51	104	

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Note—Schedules for calculating utilisation efficiency in all the appendices have been taken on the following basis :—

*(i) Bas Unit I & II—Three shifts work per day or a schedule of 3600 hours per year.

†(ii) Rehabilitation Reclamation Organisation—Single shift work per day or a schedule of 1400 hours per year.

(iii) Other Projects/Department—Two shifts work per day or a schedule of 2500 hours per year.

EQUIPMENT UTILISATION (Category-wise)

Category of Machine : Excavators

Sl. No.	State/Project or Department	Description of machines	Year of purchase	Nos.	Average total hours worked per machine		Average Utilisation as percentage of schedule		Figures of Maximum utilisation in any year during the last five years as percen- tage of schedule	
					During the last five years	From the date of initial Commis- sioning	During the last five years	From the date of initial Commis- sioning		
1	2	3	4	5	6	7	8	9	10	
STATE GOVERNMENTS										
<i>Andhra Pradesh</i>										
1. Srisailam . . .	Lima 2.5 Cyds. Tata P&H 2.5 Cyds. 955 A	1964 1965	1 4	33 538	36 956	1.3 22	1.4 38.2	6.7 30		
	Skoda Ry. 2.5 Cyds. 150	1966	1	37	36	1.5	1.4	6		
	Skoda Ry. 2.5 Cyds. 150	1965	1	28	20	1.1	0.8	6		
2. N. S. Right Canal	North West 2.5 Cyds. 5W-Walking Dragline	1957 1960	1 1	538 312	810 505	21.5 12.4	36 20	79 22		
3. N. S. Left Canal	Lima 2.5 Cyds. North West 2.5 Cyds.	1967 1958	1 1	784 979	784 1147	31 39	31 46	41 56		
4. N. S. Dam . . .	P&H 955A 2.5 Cyds.	1957	1	372	422	15	17	33		
<i>Bihar</i>										
5. Tenughat . . .	P&H 955A 2.5 Cyds Hind Marion 3 Cyds.	1965 1966	5 4	652 998	964 998	26 39	38.6 39	32 50		
<i>Delhi</i>										
6. Delhi Flood Control.	Skoda Ry. 1.25 Cyds. 22 R.B. 0.75 Cyds. Tata P&H 2.5 Cyds.	1962 1962 1967	5 3 5	1094 1053 1492	.. .. ..	43.8 42 59	.. .. ..	64.7 46 63		
<i>Gujarat</i>										
7. Ukai . . .	Osgood 2.5 Cyds. Demag 1 to 2.5 Cyds. North West 0.75 Cyds. R.B.-19-0.75 Cyds. Marion 1.5 Cyds. Tata P&H 2.5 Cyds. Tata P&H 2.5 Cyds. Tata P&H 2.5 Cyds. Hind Marion 3 Cyds. Tata P&H 2.5 Cyds.	1966 1958 1966 1966 1960 1967 1962 1963 1966 1964 1969	2 3 1 1 1 1 2 2 3 3 3	1516 1282 2082 601 1769 1452 1452 1452 1452 721 2103	1460 1155 2082 1939 1184 1452 1316 1347 1452 589 2103	60 51 83 24 71 57 57 57 57 29 84	58 46 83 79 47 57 53 54 57 23 84	76 60 83 48 91 66 66 66 66 65 84		

1	2	3	4	5	6	7	8	9	10
Haryana									
8.	Haryana Drainage	Link Belt 2.5 Cyds.	1961	1	116	481	4.6	19	22.5
		P & H 2.5 Cyds.	1964	3	942	1111	38	44.4	51
		Skoda D/Line	1962	4	1264	1721	69	50.6	74
		R. B. 3.5 Cyds.	1964	2	932	1125	37.3	45	92
Himachal Pradesh									
9.	Beas I	Tata P & H 995A 2.5 Cyds.	1964-70	4	1170	1311	46.8	52.4	71.5
		Marion 93M 2.5 Cyds.	1966	3	814	814	32.5	32.5	36
		Link Belt 2.5 Cyds.	1966	2	734	734	29.3	29.3	36
		Bucyrus-71 3.5 Cyds.	1968	2	1506	1506	60.2	60.2	80.4
10.	Uhl Hydel Stage II	Universal	1963	1	537	735	21	29.4	30.6
11.	Giri Hydel	Tata P&H 1.5 Cyds. R.B. 22 3/4 Cyds. R. B. 22	1967-68 1967 1969	2 1 1	1206	1206 1533 2000	48	48 61 80	65
Jammu & Kashmir									
12.	J&K Flood Control	Tata P&H 995 A 2.5 Cyds.	1962	3	783	852	31	34	56
		Tata P&H 995A 1.5 Cyds.	1968	1	688	688	28	28	40
		R.B. 1.5 Cyds.	1961	2	1101	1435	44	57.4	80
Kerala									
13.	Iddiki	Hind Marion 3 Cyds. Tata P&H 995A 2.5 Cyds. Universal 503 Polimax.	1968 1965 1961	1 1 3	431 1244 483	431 1244 313	17.2 50 19	17.2 50 12.5	18.8 50 35
Maharashtra									
14.	Mula	Hind Marion 101M 3 Cyds. Tata P&H 955A 2.5 Cyds. Tata P&H 955A 2.5 Cyds.	1966 1965 1959	3 1 1	1070 472 ..	1070 472 420	43 19 ..	43 19 17	55 36 ..
15.	Jaykawadi	Hind Marion 3 Cyds.	1966	2	378	378	15	15	24
Mysore									
16.	Ghataprabha Pro- ject.	Tata P&H Shovel	1966	4	..	336	..	13.4	18.4
Madhya Pradesh									
17.	Tawa	Tata P&H 2.5 Cyds. Hind Marion 2.5 Cyds.	1963-66 1964	2 2	207 36	338 570	8 1.4	13.5 23.0	16 1.4
Orissa									
18.	Balimela	Russian EXG 4.6 Cyds. Russian E1252 1.6 Cyds. Lima 3.5 Cyds.	1963-66 1964 1969	5 8 5	1225 1264 206	1257 285 206	49 10.6 8.2	50 11 8.2	71 28 8.2

1	2	3	4	5	6	7	8	9	10
<i>Punjab</i>									
19.	Beas II	Hind Marion 3 Cyds.	1969	1	3564	3564	99	99	100
		Tata P&H 2.5 Cyds.	1966	3	1611	1681	44.7	47	52
		150 B Elect. 7 Cyds.	1964	1	3208	3886	89	108	125
		150 B Elect. 7 Cyds.	1970	1	3389	3389	94	94	94
		P&H 7 Cyds.	1968	1	4000	4000	111	111	144
		71B Elect. 3.5 Cyds.	1969	1	4103	4103	114	114	133
		Tata P&H 2.5 Cyds.	1965	3	2372	2603	66	75	80
		Tata P&H 2.5 Cyds.	1967	1	2372	2372	66	66	80
		Tata P&H 2.5 Cyds.	1963	1	2372	2630	66	73	80
<i>Rajasthan</i>									
20.	Rajasthan Canal	Tata P&H 3 Cyds.	1963	8	1192	1378	18	55	53
		Tata P&H 2.5 Cyds.	1961	5	848	1114	34	44.6	48
<i>Tamil Nadu</i>									
21.	Perambikulam Aliyar.	UNICOP	1961	3	..	430	..	17.2	..
<i>Uttar Pradesh</i>									
22.	Yamuna	North West 1.5 Cyds.	1956-57	2	249	527	10	21	23
		Marion 2.5 Cyds.	1961	2	294	1276	11.7	51	19.2
		Tata P&H 2.5 Cyds.	1962-63	3	406	567	16.2	22.7	27.8
23.	Ramganga	Tata P&H 955-A 2.5 Cyds.	1964	6	852	1093	34	44	45
		Tata P&H 955-A 2.5 Cyds.	1970	2	852	852	34	34	45
		Tata P&H 955-A 2.5 Cyds.	1964	4	770	748	31	30	46
		Tata P&H 955-A 2.5 Cyds.	1966	2	770	748	31	30	46
		Tata P&H 955-A 2.5 Cyds.	1970	2	770	748	31	30	46
		Marion 7 Cyds.	1966	1	1952	1952	78	78	151
<i>West Bengal</i>									
24.	Kansabati	R.B.-10	1957	2	663	442	27	18	28
		Tata P&H	1968	2	119	119	5	5	5
<i>GOVT. CORPORATIONS</i>									
25.	Nayveli Lignite	R.B.-54 3.5 Cyds.	1958	2	1557	2104	62.3	84	79.2
		Tata P&H 955-A 2.5 Cyds.	1967	2	1557	1557	62.3	62.3	79.2
		P&H-I.5 Cyds.	1963	1	1557	761	62.3	30.4	79.2
26.	H.S.L. Bhilai	P&H-955A 2.5 Cyds.	1958	2	422	100	17	4	33.3
27.	H.S.L. Barsua Mines.	P&H-1300. 4 Cyds.	1959	4	1340	1503	56	60	74
28.	N.M.D.C. (Kiriburu)	B.E.-100	1962	4	2118	2118	85	85	88
		P&H-955.	1962	2	144	144	6	6	8
29.	N.M.D.C. (Bailadila)	Tata P&H Russian	1969	2	492	492	20	20	23
			1966-67	5	1213	1213	49	49	99
30.	N.M.D.C. Donamala	Hind Marion-93M	1969	1	1420	1420	57	57	57

1	2	3	4	5	6	7	8	9	10
31. N.P.C.C.		P&H-955 2.5	1964	4	797	939	33	37.6	13.5
		Hind Marion 93-M	1963	6	923	990	37	39.6	60
		Hind Marion 362-M	1962	1	366	489	14.5	19.6	36
		Lima-803	1965	3	841	1097	34	44	55
		North West-14	1964	1	210	293	8.4	11.7	8.4
		Priestman VX	1963	1	86	861	3.5	34.4	12
		Hitachi 'U'	1964	1	453	754	18.1	30.2	54
		Skoda-150	1964	1	238	337	9.5	13.5	9.5
32. N.C.D.C.		110 R.B.	1957	4	..	2301	..	92	107
		110-B	1959	3	..	3344	..	134	147
		P&H-1300	1958	3	..	2418	..	97	103
		P&H-1600	1960	4	..	2420	..	97	109
		Marion 4161	1959	4	..	2199	..	88	115
PRIVATE BODIES									
33. H.C.C.		Tata P&H-955-A	1965	1	2312	2312	92.5	92.5	116
		Link Belt Sk-500	1965	3	526	526	21	21	38
		R.B.--22	1967	2	856	856	34.2	34.2	61
		Demag	1965	3	841	841	33.5	33.5	75.5
34. TISCO		Tata P&H	1961	2	3280	3500	131	140	144
		Tata P&H 955-A	1966	5	3075	3075	123	123	136
		Menck M-90	1958	2	2498	2648	100	106	106
		Bucyrus	1957	1	3120	2600	125	104	136

APPENDIX 2.2.2

EQUIPMENT UTILISATION (CATEGORY-WISE)

Category of Machine : Tractors [Crawler]

S. No.	State/Project or Department	Description of Machines	Year of purchase	No. of machines	Average total hours worked per year per machine		Average utilisation as percentage of Schedule		Figure of max. utilisation in any year during the last five years as percentage of Schedule
					During last five years	From the date of initial Commissioning	During the last five years	From the date of initial Commissioning	
1	2	3	4	5	6	7	8	9	10

STATE GOVERNMENTS

Andhra Pradesh

1. Srisailam		Russian DET-250	1966	2	41	41	1.6	1.6	5
		Cat. D-7	1964	2	1086	956	43	38.2	102
		Cat. D-8	1965	1	509	530	20	21.2	24
		I.H-TD 24	1963	2	661	401	26	16	55
2. N. S. Right Canal		IH-TD-24	1957	5	90	380	3.6	15.2	9
		IH-TD-18	1957	4	112	250	4.5	10	17
		Cat. D-8	1957	2	644	635	26	25.4	54
		Cat. D-7	1957-65	2	653	968	26	38.7	57
		HD-11	1958	5	1	260	0.04	10.4	0.04
		IH-BTD-6	1957-59	9	77	224	3	9.0	6

1	2	3	4	5	6	7	8	9	10
3.	N. S. Left Canal.	AC-HD-21	1958	2	564	552	23	23	77
		AC-HD-16	1958-60	11	284	321	11	13	24
		IHI-TD-24	1957-58	5	166	501	7	20	17
		Cat. D-8	1957-68	18	662	903	26	36	30
		Cat. D-7	1957-68	12	713	537	29	21	36
		Cat. D-9	1965	2	173	736	7	29	7.4
		AC-HD-6	1958	80	101	170	4	7	10
		Cat. D-6	1958	20	544	49	22	2	22
		BTD-6	1957	150	181	314	7	12	17
<i>Bihar</i>									
4.	Tenughat . .	AC-HD-21	1956	2	162	513	6	20.5	8
		AC-HD-9	1966	20	87	1538	3	61.5	4
		Cat. D-7	1966	2	376	1883	15	75.3	24
		Russian T-100M	1967	30	701	763	28	30.5	44
		Russian DET-250	1967	16	697	719	28	24.8	45
		BEML Komatsu	1968	5	689	689	28	28	38
		BEML Komatsu	1969	3	689	689	2.8	2.8	38
		BEML Komatsu	1967	1	689	707	28	28.3	38
		Let. (wheeled)	1966	20	89	89	4	4	4
<i>Delhi</i>									
5.	Badarpur Thermal Komatsu D-8 Power Project		1970	1	800	800	32	32	32
6.	Delhi Flood Control Russian T-100M		1967	50	989	..	40	..	47
<i>Gujarat</i>									
7.	Ukai . .	Cat. D-8 14A	1961	7	1284	..	51	..	60
		Cat. D-8 14A	1963	2	1284	..	51	..	60
		Cat. D-8	1966	2	1284	..	51	..	60
		Cat. D-8	1969	1	1284	..	51	..	60
		Cat. D-8	1956	1	1284	..	51	..	60
		Cat. D-8	1958	1	1284	..	51	..	60
		Cat. D-8 H	1965	4	1772	..	78	..	101.4
		Komatsu D-120 and D-80-8	1966	4	1000	1000	40	40	..
		TD-24	1961	3	611	828	24	33	36
		TD-25	1965	9	937	1253	37	50	64
		Cat. D-9	1965	3	1376	1448	55	58	68
		CD-8C	1966	34	650	650	26	26	35
		CD-10G	1967	5	612	612	24	24	33
<i>Haryana</i>									
8.	Haryana Drainage Circle	Cat. D-7	..	1	110	110	4.4	4.4	4.4
		Cat. D-8	..	1	45	45	2	2	2
<i>Himachal Pradesh</i>									
9.	Beas-1 . .	Cat. D-8	1963	11	1668	1219	66.6	48.8	100.7
		Cat. D-7	1963	6	869	731	34.8	29.2	49.3
		Komatsu D-80	1968-69	18	883	883	35.3	25.3	53.2
10.	Uhl Hydel Stage II	Cat. D-7	1962	3	678	1068	27	42.6	62
11.	Giri Hydel	Cat. D-6	1967	10	1405	1405	56	56	59
		Crawler 100 HP	1969	10	15	15	0.6	0.6	0.6
		Komatsu	1969	1	1051	1051	42	42	49
<i>J. & K.</i>									
12.	J&K Food Control	Cat. D-7	1963	2	459	440	18	17.6	28
		Cat. D-8	1961	8	574	695	13	28	35

1	2	3	4	5	6	7	8	9	10
Kerala									
13.	Iddiki	Komatsu D-80 AC-HD 16	1970 1958	2 2	113 587	113 500	4.5 23.5	4.5 20	4.5 33
Madhya Pradesh									
14.	Tawa	AC-HD-21 Cat. D-6 Cat. D-8	1965 1965 1969	14 60 2	377 620 173	534 529 173	15 25 7	21.3 21 7	23 35 10
Maharashtra									
15.	Mula	Cat. D-8 Russian DET-250 Komatsu D-80	1967 1965 1970	14 6 3	1042 501 133	1042 501 133	43 20 5.3	43 20 5.3	52 43.8 5.3
16.	Jayakwadi	Cat. D-7 Cat. D-8.68A Cat. D-8. 22A Cat. D-8. 46A French CD-100	1966 1965 1967 1967 1967	6 8 2 4 12	1560 475 724 400 600	1560 475 724 400 600	60 19 29.6 16 24	60 19 29.6 16 24	72 44 67 28.4 27.6
Mysore									
17.	Ghataprabha	Cat. D-9 C-100 CD-100 IH-TD-18A	1966 1969 1967 1954-55	3 70 30 2	.. 2081 261 297	1732 .. .. ..	.. 83.2 10.4 11.8	69.3 83.2 10.4 11.8	72.1 109 18.8 14.8
Orissa									
18.	Balimela	Russian T-100M Cat. D-8 Komatsu D-120	1968 1964 1963	200 4 4	458 600 1104	.. 548 670	18.3 24 44	.. 22 27	31.2 33 84
Punjab									
19.	Peas II	Cat. D-8 Cat. D-8 Cat. D-9 Cat. D-9 Cat. D-9	1969 1963 1965 1963 1969	20 4 5 4 5	4207 2027 2365 2365 4682	4207 2158 2694 2090 4682	117 56.3 66 66 130	117 60 75 58 130	143 74 93 93 130
Rajasthan									
20.	Rajasthan Canal	IH-TD-25 Cat. D-8	1964-67 1960-64	27 13	1268 1490	1618 1698	51 56	64.7 68	82 82
Tamil Nadu									
21.	Parambikulam Aliyar	Komatsu Cat. D-7 Cat. D-9	1962 1959 1965	2 2 2	84 53 1241	418 821 1241	3.3 2.1 50	16.3 33 50	3.3 19 64
Uttar Pradesh									
22.	Yamuna	Cat. D-8 Euclid C-6 Komatsu D-80	1960 1964 1970	3 2 2	540 682 382	945 757 382	21.6 26.3 15	39.8 30 15	32 35.2 15
23.	Ramganga	Cat. D-8 Cat. D-9 Komatsu D-120	1962 1969 1963	3 12 2	57 1103 139	62 1103 188	2.3 44 5.6	2.5 44 7.5	2.3 44 9

1	2	3	4	5	6	7	8	9	10
Ramganga (contd.)		Komatsu D-80	1969	9	965	965	39	39	39
		Euclid TC-12	1964-65	17	832	1079	38.3	43	65
		IH-TD-25	1966	10	817	817	90	33	58
		Euclid C-6	1964	14	1207	1196	48	48	73
<i>West Bengal</i>									
24.	Kangsabati	Cat. D-8	1957-62	15	483	594	19	24	23
		Cat. D-8	1966	1	714	714	29	29	36
		Komatsu D-120	1968	2	580	580	23	23	26
		Cat. D-7	1961	1	304	..	12	..	34
		IH. TD-18	1958	3	164	270	7	11	17
		Cat. D-4	1958-60	80	39	141	1.6	5.6	4
		Cat. D-9	1957	2	335	653	13	26	23
		A.C.H.D.-5	1955	20	287	287	11	11	22
CENTRAL GOVERNMENTS									
25.	Rehabilitation Reclamation	Komatsu D-80	1959	16	635	582	45.3	41.6	54.6
		A. C. H. D.-21	1965	15	1118	1118	80	80	110.7
		Cat. D-8	1961	45	684	750	49	53.6	54.6
		French RC-10G	1966-67	15	940	940	67	67	78
CORPORATIONS									
26.	Neyveli Lignite	Cat. D-8	1965-66	15	2786	..	111.4	..	120.
		Cat. D-9	1958	2	1465	1431	58.6	57.2	74.4
		Euclid C-6	1965-66	2	1229	..	61.1	..	101.5
		Komatsu D-120	1969	5	1767	..	70.7	..	77
27.	H.S.L. Rourkela	TD-24	1959	1	1960	2727	78.4	109	144
		TD-25	1964	2	3100	3017	124	120.7	160
		D-4	1966	2	2360	2360	94	94	170
		Bharat	1969	1	5700	5700	228	228	228
		Let	1964	3	1375	1375	55	55	88
28.	H.S.L. Bhilai	A.C.H.D. 6	1956	5	108	189	4.3	7.6	14.3
		Do. 21	1956	3	360	780	14.4	31.2	23.5
29.	H.S.L. Barsua Mines	TD-24	1956	3	336	1053	13.4	42	23.3
30.	MMDC (Baladila)	Cat. D-9	1967	4	2014	2014	81	81	122
		TD-25	1964	3	1605	1605	64.2	64.2	..
31.	NMDC (Kiriburu)	IH. TD-25	1962	0	711	711	28	28	28
		Cat. D-9	1967	1	1078	1078	43	43	43
		BEML D-120	1971	3	691	691	28	28	28
32.	NMDC (Donamalai)	D-80	1969	2	1870	1870	75	75	75
33.	N.P.C.C.	TD-25	1965	10	979	948	39	38	65.5
		Komatsu D-120	1962	18	185	492	7.4	19.6	22.6
		Komatsu D-80	1962	7	452	703	18	28	32
		Komatsu D-50	1963	2	165	393	6.6	16	15.4
		HD-20	1963	3	188	142	7.5	6	31.4
		HD-19	1964	3	67	187	2.7	7.6	2.7
		HD-16	1964	2	119	99	5	4	14
		Russian C-100	1966	2	61	896	2.4	36	8.6
		Enico- C-106	1962-65	2	301	431	12	13.2	35
		Euclid C-6	1962	1	306	553	12.2	22	24.5
		D-8	1964	1	188	42	7.5	2	4.2

1	2	3	4	5	6	7	8	9	10
34.	N.C.D.C.	Cat D-8 Cat. D-9 D-80 TD-25 TD-24	1963 1963 1970 1961 1956	30 13 5 5 3	.. .. .. .. ..	1848 1398 2326 1101 905	.. .. .. .. ..	74 56 97 44 36	100 85 135 58 42
PRIVATE BODIES									
35.	H.C.C.	Cat. D-8 Komatsu D-120 Cat. D-8	1965 1968-69 1966	1 5 1	1166 1380 1388	1166 1380 1388	46.6 55.2 55.5	46.6 55.2 55.5	61 72.4 82
36.	TISCO	IH-TD-25 Cat. D-9 IH-TD-25 IH-TD-25 IH-TD-25 Komatsu D-120 IH-TD-25	1967 1961-64 1963 1966 1967 1969 1961	1 3 1 2 2 1 2	1172 2520 3320 3320 3320 3320 3320	1172 2070 2460 3320 3320 133 2400	47 101 133 143 133 133 133	47 83 98.4 133 133 133 96	58 144 150 150 150 150 150

APPENDIX 2.2.3

EQUIPMENT UTILISATION (CATEGORY-WISE)

Category of Machine : Dumpers

Sl. No.	State/Projects or Department	Description of machines	Year of purchase	No. of machines	Average total hours worked per year per machine		Average utilisation as percentage of Schedule		Figures of max. utilisation in any year during the five years as percen- tage of Schedule
					During the last five years	From the date of initial Commis- sioning	During the last five years	From the date of initial Commis- sioning	
1	2	3	4	5	6	7	8	9	10
STAT GOVERNMENTS									
<i>Andhra Pradesh</i>									
1.	Srisailam	Russian MAZ-525(14) Euclid B-3-FD (11) Euslid B-1-TD(14-18) Mogurt (6)	1966 1964 1966 1966	9 11 7 4	157 273 311 311	.. 640	6 11 12 12	.. 25.6	20 14 20 20
2.	L.S. Left Canal	Let D (9)	1960	4	242	224	10	9	15
3.	N.S. Dam	Euclid B-2-TD (11) Mogurt (6) Let D Tournapul (9)	1957 1964 1963	4 7 4	591 401 875	457 418 830	23.6 16 35	18 16.7 33	23.6 23 51
<i>Bihar</i>									
4.	Tengughat	Euclid FDT-77 (14) Russian MAZ-525(14) Russian Belaz-540 (18)	1965 1966 1967	9 8 30	189 752 758	1483 752 789	8 31 30	60 31 31.6	10 .. 42
<i>Gujarat</i>									
5.	Ukai	Let West 'C' Pull (17) Let West 'C' Pull (17) Cat 619-C (20) Let West V.C. Let West (New)	1961 1966 1965 1965-68 1968-69	2 5 7 16 28	206 206 1351 1046 1152	800 .. 1351 1046 1152	8.2 8.2 54 42 46	32 .. 54 42 46	14 14 63 61 60

1	2	3	4	5	6	7	8	9	10
<i>Himachal Pradesh</i>									
6.	Beas - I	Tourna Rocker Euclid B-2-TD B-14-FD	1964 1964 1967	16 9 14	834 1516 1103	1125 2056 1103	33.3 60.6 44	45 82.2 44	40 77 54
7.	Uhl Hydel Stage II	Mogurt DR-50(6)	1963	8	676	734	27.0	29.4	38.6
8.	Giri Hydel	Mogurt (6) 'C' Pull (17)	1967 1968	8 1	520 1368	520 1368	21 55	21 55	26 82
<i>J. & K. STATE</i>									
9.	J & K Flood Control.	Euclid 94-FD Mack M-18-X (17) Mogurt DR-50 (6)	1961 1963 1963	11 7 4	353 468 72	650 474 81	14 19 3	26 19 3.2	27 31 8
<i>Kerala</i>									
10.	Iddiki	Sicard Mogurt DR-50 (6)	1968 1961	12 22	152 40	152 40	6.1 1.6	6.1 1.6	7.55 4
<i>Madhya Pradesh</i>									
11.	Tawa	Cat 619-C (20) Euclid 70-TD (20)	1965 1964	4 12	154 233	80 328	6 9.3	3.2 13	19 17
<i>Maharashtra</i>									
12.	Mula	Let C Pull (17) Cat. (20) Russian Maz (17)	1968 1968 1965	8 10 12	1196 644 647	1196 644 647	47.8 25.8 25.8	47.8 25.8 25.8	58.5 29 43
13.	Koyna Hydel	Avelin Barford (9) Mogurt ()	1956-58 1966	14 5	543 811	315 811	22 32	12.6 32	61 115
<i>Mysore</i>									
14.	Ghataprabha	Mogurt (6) Russian (14)	1959-66 1967	5 22	..	558 146	.. ..	22.3 5.8	48 11.3
<i>Orissa</i>									
15.	Balimela	Russian Maz 525(17) Mack M-25 (17) Cat. DW-20 (17) Cat. 630-B (40)	1964-65 1968 1967 1969	50 7 16 5	391 568 827 2704	400 547	16 22.7 33 108	16 21.8	55 33 44.4 108
<i>Punjab</i>									
16.	Beas - II	Euclid 36 LTD(40) Cat. PW-621 (20) Cat. PW-630 (40) Euclid B-2-TD (18) Euclid 15-FDT (30) III. PH-100 (20)	1968 1969 1969 1963 1964 1969	12 36 14 11 8 13	2584 3411 2514 2626 3328 3340	2584 3411 2514 2712 2896 3340	72 65.3 70 73.5 93 134	72 65.3 70 75 80 134	81 95 102 113 133 178
<i>Uttar Pradesh</i>									
17.	Yamuna	Let. C Pull (17)	1962	12	352	719	14	28.4	20
18.	Ramganga	Euclid 36-LTD(40) Cat. PW-630 (40) Cat. 619-C (20) Euclid 70-TD (20) Mogurt (6)	1966 1968-69 1969 1964 1963-66	13 12 14 25 9	506 1029 129 364 40	506 1029 129 934 72	20.2 41 5 35 2	20.2 41 5 37 3	50 76 12 49 3

1	2	3	4	5	6	7	8	9	10
<i>West Bengal</i>									
19.	Kangsabati	. Tournapull Super (17)	1962	5	44	70	1.8	2.8	2.1
GOVERNMENT CORPORATIONS									
20.	Neyveli Lignite	Cat. DW-20	1967	10	1696	1669	67.8	67.8	81
		Cat. 630-B	1966	8	2243	2243	90	90	98
		Haulpak LW-35	1969	1	233	233	9	9	9
21.	H.S.L. Rourkela	Leyland	1961	8	166	1584	7	63.4	11
22.	H.S.L. Bhilai	Mack	1958	4	337	330	13.5	13.2	20
23.	H.S.L. Barusa Mines	Mack	1956	8	930	1307	37	50.7	44
		Haul Pak	1962	3	930	1161	37	46.4	44
		Haul Pacak	1969	5	930	2188	37	87.5	44
24.	N.M.D.C. Bailadila	IH-100	1965	18	1425	1425	57	57	64
		Scammel	1968	3	454	454	18	18	30
25.	N.M.D.C. Kiriburu	Euclid 66-TD	1962	18	1097	..	44	..	48
		Euclid 94-FD-7	1969	4	1097	1097	44	44	48
		BEML CFA-15-TH	1969-70	6	1097	1097	44	44	48
26.	N.C.D.C.	Euclid B-ITD	1956	8	..	716	..	29	36
		B-3-TD	1956	25	..	987	..	39	51
		Mack LVX	1956	7	..	631	..	25	36
		Euclid 46-TD	1959	40	..	1020	..	41	71
		Haulpak LW-32	1962	21	..	1011	..	40	61
		Mack M-30-X	1965	21	..	1819	..	73	119
		Euclid 11-LD	1965	15	..	1626	..	65	103
		MAZ-525	1965	23	..	822	..	33	45
		BELAZ-540	1967	24	..	1958	..	78	100
		Haulpak LW-35	1969	17	..	2369	..	95	157
		Haulpak LW-35	1970	33	..	1371	..	55	127
		Euclid B-6-FD	1959	9	..	841	..	34	56
		Euclid B-7-FD	1960	39	..	1006	..	40	64
		Coal Hauler	1963	14	..	873	..	35	82
27.	N.P.C.C.	Euclid B-94-FD	1962	1	89	686	3.6	27	17.3
		Euclid B-7-FD	1963	2	141	192	6	7.7	12
		Let.	1963	4	540	454	21.6	18	41
		Leyland	1963	17	29	277	1.2	11.1	4.3
		IH-Payhuler	1965	10	892	892	36	36	53.4
		Mogurt	1963	12	77	339	3	13.6	8.4
PRIVATE BODIES									
28.	H.C.C.	Euclid 80-FD	1965	14	628	628	25	25	38
		Kolshring -140	1967	8	1199	1199	48	48	74.2
29.	TISCO	Euclid B-3-FD	1958	7	2800	3000	112	120	120
		Mack M-25-X	1966	7	3350	3350	134	134	144
		Mack M-45-X	1966	4 ..	2780	2780	111	111	152

EQUIPMENT UTILISATION (Category-wise)

Category of Machine—Scrapers (Motorised).

Sl. No.	State/Project or Department	Description of machine	Year of purchase	No. of machines	Average Total hrs. worked per yr. per machine		Average utilisation as %age of Schedule		Figure of Max. utili- sation in any yr. during last five years as %age of schedule
					During last 5 yrs.	From the date of initial commis- sioning	During last 5 yrs.	From the date of initial commis- sioning	
1	2	3	4	5	6	7	8	9	10
STATE GOVERNMENTS									
<i>Andhra Pradesh</i>									
1. N.S. Right Canal	Cat. 62 F.	1963-65	7	560	739	22	29.6	43	
	Cat. DW-15	1956-57	6	356	593	14	23.7	29	
	A.C.T.S.-360	1961	3	113	323	4.5	12	4.6	
2. N.S. Left Canal	Let C-(14-18)	1965	12	1111	817	44	32.7	118	
	Let. (14-18)	1963	11	557	1696	22.3	44	43	
	A.C.T.S. 360	1958	6	84	329	3.4	13	8	
	Let. D-Roadster	1958	2	24	50	1	2	4	
	Cat. 621-C	1968	7	1276	1414	51	56.6	61	
	WABCO-C	1969-70	20	504	917	20	36.7	34	
	Cat. 619-C(14-18)	1963-65	15	82	664	3.3	26.6	14	
<i>Bihar</i>									
3. Tenughat	Let	1968	8	932	..	37	37	42	
<i>Gujarat</i>									
4. Ukai	Let. West 'C' (14-18)	1958	9	575	780	23	31	51	
	Euclid B6 FDT(14-18)	1957	4	417	411	16.7	16	28	
	do	1966	5	417	—	16.7	—	28	
	D. W. 15 (16)	1966	5	303	—	12	—	23.7	
	Let. West V. O. old	1966	8	515	—	20.6	—	38.3	
	Let. West V. O. new	1967-68	45	1814	—	72.6	—	73.5	
<i>Jammu & Kashmir</i>									
5. J. & K. Flood Control	Let (14-20)	1962	3	527	398	21	16	62	
<i>Madhya Pradesh</i>									
6. Tawa	AC-TA-260 (15-20)	1964	6	115	329	4.6	13	12.6	
	Let. 5. (14-20)	1965	3	274	320	11	13	30.7	
	Cat. 619C.	1965	10	491	540	20	20	29	
<i>Maharashtra</i>									
7. Mula	Tourapul(14-20)	1965	6	894	894	35.7	35.7	66.3	
	Cat. 619B	1964	5	1496	1694	60	68	73.8	
	Euclid B-6FDT	1965-68	4	579	579	23	23	51.8	
8. Jayakwadi	Cat 619 C	1965	6	1716	1716	72	72	90	
	BEME Let. C.	1968	6	894	894	36	36	57	
	Let. C.	1960	7	420	466	17	18.6	23	
	Euclid Bish	1960	3	780	630	31	25	41	
<i>Mysore</i>									
9. Ghataprabha	Terra Cobra.	1950-54	2	..	160	..	6.4	8.3	
	LWB-70 (25)	1965	3	..	664	..	26.6	33.1	
	L.W.C.-Bull	1966-69	8	..	992	..	40	68	
<i>Rajasthan</i>									
10. Rajasthan Canal	Euclid 320 HP(18-22)	1961	5	590	542	24	21.7	38	

1	2	3	4	5	6	7	8	9	10
Tamil Nadu									
11.	Parambikulam Aliyar	Cat. DW-20 Cat.-37-C Cat. 67-C LW-B. 70 (25)	1961 1961 1959 1965	9 1 4 5	750 247 563 367	1360 1360 1228 381	30 10 22.5 15	64.4 64.4 49 15	37.4 22.4 40 24
Uttar Pradesh									
12.	Ram Ganga	LW-B70	1964-65	33	226	470	9	18.1	15
West Bengal									
13.	Kangsabati	Let Tournapul Cat. DW-21 Cat. 621	1965 1957 1968	4 13 6	287 676 2715	287 926 2715	11 27 109	11 37 109	22 33 112
GOVERNMENT CORPORATIONS;									
14.	H.S.L. Bhilai	AC-TS-360 Let. 'C'	1956 1956	8 7	137 57	451 513	5.5 2.3	18 20.5	11.1 3.9

APPENDIX 2.2.5.**EQUIPMENT UTILISATION (Category-wise)****Name of Machine—Cranes**

S. No.	State/Project or Department	Description of machine	Year of purchase	No. of machines	Average total hrs. worked per year per machine		Average utilisation as percentage of schedule		Figure of Max. utili- sation in any yr. during last 5 yrs as % age of schedule
					During the last 5 yrs.	From the date of initial comsng.	During the last 5 yrs.	From the date of initial comsng.	
1	2	3	4	5	6	7	8	9	10

STATE GOVERNMENT**Andhra Pradesh**

1.	Srisailam	Lima truck mounted 25T	1966-68	2	381	381	15	15	40
2.	N.S. Right Canal	C-13 Jones, 6.5T C-14 Cat. T	1966 1958	1 1	371 371	442 116	15 15	18 5	22 22
3.	N.S. Left Canal	Lima 20T Bucyrus Erie 7.5 T	1968 1960	1 1	571 178	.. 70	23 7	.. 2.8	24 10
4.	N.S. Dam	Lorain 182, 10T I.H. Super-BMD. 5T	1959 1957	1 2	125 168	218 402	5 57	8.7 16.0	8 27

Delhi :

5.	Badarpur	Tata P&H 75 T	1968	1	533	533	21	21	32
	Thermal Power Project	-do- 35 T	1968	1	400	400	16	16	32
		Coles 12.5T	1969	1	567	567	23	23	32

Jammu & Kashmir

6.	Flood Control	R.B. 15T	1962	2	156	188	6	7.5	11
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1	2	3	4	5	6	7	8	9	10
Kerala									
7. Iddiki	.	Link Belt	1968	1	152	152	6	6	10
<i>Madhya Pradesh</i>									
8. Tawa	.	Coles 10 tons Buckey 5 tons	1962 1966	1 1	34 17	255 17	1·4 0·7	10 0·7	2·9 2·2
<i>Maharashtra</i>									
9. Mula	.	Coles 12.5T	1967	1	591	591	23·6	23·6	32·5
<i>Mysore</i>									
10. Ghataprabha	.	Coles	1968	1	..	346	..	14	14
<i>Uttar Pradesh</i>									
11. Yamuna	.	Fowler I.H. Link Belt	1960 1962	1 1	187 33	193 ..	7·5 1·3	8 ..	13 2·4
12. Ramganga	.	Coles S-1210 10T Lime 100 Tons Manitowac	1964 1966 1968	6 1 1	226 559 517	387 559 517	9 22·3 20·7	15 22·3 20·7	15 43 20·7
<i>West Bengal</i>									
13. Kangsabati	.	Lima K-58	1961	2	103	302	4	12.0	12
CENTRAL GOVERNMENT									
14. Rajasthan Atomic Power Project	P&H-955 P&H-955 Bucyrus Coles Anneas	1955 1955 1968 1965	1 1 1 1	804 908 1227 1396	804 908 1227 1396	32 36 49 56	32 36 49 56	57 71 56 78	
15. Madras Atomic Power Project	Coles Anneas Bucyrus 25-B P&H-955-A	1967 1968 1968	1 1 1	502 205 370	502 205 370	20 8 15	20 8 15	24 17 24	
GOVERNMENT CORPORATIONS									
16. Neyveli Lignite	Let. D-20-T Let. D-10-T P&H-955-A-75-T IH-Fowler-5-T	1959-62 1960-63 1961 1966	4 4 2 8	4364 3413 1965 2567	3037 2839 1188 2732	174·5 136·5 68 103	112·5 113·6 57·6 109·3	189·5 139·4 102 112	
17. H.S.L. Rourkela	Lima-12-T Lima 75-T P&H-255 P&H-255 Demag 7-T P&H-655-B/27T P&H-155 Coles 10-T Coles 45-T	1963 1968 1963 1959 1959 1964 1965 1964 1965	1 1 1 1 1 3 3 1 2	.. .. 2680 1520 1040 1108 1080 500 750	2971 3600 2857 2682 1817 1009 946 508 640	.. .. 107 61 42 44 43 20 30	118 144 114 107 72 40 38 20 26	.. .. 128 88 64 88 76 52 42	
18. H.S.L. Bhilai	Coles Limca 24-W Limca 604 P&H 255-ATC P&H 655-B P&H 655-BLC P&H 855-BLC	1958 1956 1956 1957 1959 1958 1959	5 4 5 2 4 3 6	150 480 680 952 253 550 460	670 900 1062 1130 916 875 640	6 19·2 27·2 38·1 10 22 18·4	27 36 42·5 45·2 36·6 35 25·6	12 38·4 34·2 53·5 30 32 29·2	

1	2	3	4	5	6	7	8	9	10		
		Russian Track	1958	3	195	660	7·8	26·4	13·2		
19.	N.C.D.C.	EKG 4 Russian	1962	2	..	1466	..	59	70		
		EKG 6 Russian	1963	7	..	1703	..	68	109		
		EKG 6 Russian	1965	2	..	2003	..	80	82		
		EKG 6 Russian	1966	5	..	3157	..	126	149		
		EKG 8 Russian	1963	4	..	1341	..	54	73		
		P&H 955-A	1957	8	..	1001	..	40	48		
		Lorain L-85	1959	8	..	1004	..	40	51		
		Lima 803	1956	1	..	1174	..	47	47		
		Tata P&H 955-A	1965	6	..	2044	..	82	143		
		W/Dragline	1960	2	..	2880	..	115	128		
		P&H 1855	1959	2	..	1672	..	67	76		
		Marion D/L 7800	1960	2	..	1848	..	74	148		
		Marion D/L 7400	1963	1	..	3337	..	134	134		
		Russian ESH 4/45	1963	2	..	1029	..	41	49		
		Russian	1963	1	..	509	..	20	20		
		PRIVATE BODIES									
20.	H.C.C.	Galion	1967	2	1286	..	51·4	..	80		
		Hincon (fixed)	1969	4	1276	..	51	..	103·6		
21.	TISCO	Lima 15-T	1952	1	2400	2400	96	96	96		
		Hyster KE	1955-58	3	2220	2250	88·8	90	96		
		Coles 710	1958	3	2500	2583	100	103	100		
		Coles 1210	1959	2	..	2520	..	100	..		
		Tata P&H 35-T	1967	1	..	3000	..	120	..		
		P&H 655-B	1958	2	2500	2300	100	92	100		
		P&H 655-B	1967	1	2500	2500	100	120	100		

APPENDIX 2.3

COMPARISON OF THE CAPITAL INVESTMENT AND THE END COST OF WORKS BY OPERATING MACHINES IN SINGLE, DOUBLE AND THREE SHIFTS -- (A TYPICAL EXERCISE).

Operation with	Excavators & Dumpers
Quantity of work	— 6 M. Cu. m.
Period	— 6 years
Quantity per year	— 1 M. Cu. m.
Cost of 2 Cu. Yds. Shovel	— Rs. 10 lakhs.
Cost of 25-T Dumper	— Rs. 5 Lakhs.

Depreciation in declining balance method (Appendix 8.4)

Repair Expenditure as a percentage of cost (Appendix 8.7)

	Single Shift Operation	Double Shift Operation	Three Shifts Operation
Utilisation hours	1200	2000	2500
Quantity/hour in Cu. m.	835	500	400
Shovel Dipper Yd.	14·0	8·3	6·7
No. of Shovels 2.5 cu. yds. capacity	5·6	3·32	12·68
Dumpers 25-T @ 5 per shovel	28·0	16·6	13·4
Investment	$5·6 \times 10$ + 28 × 5 = 196·0	$3·32 \times 10$ + 16·6 × 5 = 116·2	$2·68 \times 10$ + 13·4 × 5 = 93·8
Ratio	1	0·6	0·48
End Cost	373·00	303·00	295·00
Ratio	1	0·816	0·79

OWNING & OPERATING COST
SINGLE SHIFT OPERATION

SHOVELS*Ownership Cost*

Dep. in 6 years at 15%	6,22,850
Interest in 6 yrs at 6% of average annual investment	2,49,140
	<hr/>
for 5.6 machines	8,71,990
	<hr/>
	48,83,144

Operating Cost

Repair expenditure 25%	2,50,000
P.O.L.	3,20,760
Labour	70,000
	<hr/>
for 5.6 machines converted to present worth at 6% interest	6,40,760
	<hr/>
Total:	29,23,878
	<hr/>
	78,07,002

DUMPERS*Ownership Cost*

Dep. in 6 yrs. at 20%	3,68,928
Interest in 6 yrs. at 6% of average annual investment	1,10,678
	<hr/>
for 28 Dumpers	4,79,606
	<hr/>
	1,34,28,980

Operating Cost

Repairs expenditure at 40%	2,00,000
P.O.L.	2,85,120
Labour	36,000
	<hr/>
For 28 Dumpers converted to present worth at 6% interest	1,18,89,624
Tyres two replacements converted to present worth	41,06,794
	<hr/>
Total :	2,94,25,398
	<hr/>
Total expenditure at present worth for Single Shift Operation	3,72,32,420

SHOVELS*Ownership Cost*

Dep. in 6 yrs. at 20%	7,37,856
Interest in 6 yrs. at 6% of average annual investment	2,21,357
	<hr/>
for 3.32 machines	9,59,213
	<hr/>
	31,84,586

Operating Cost

Repairs at 40%	4,00,000
P.O.L.	5,34,600
Labour	1,40,000
	<hr/>
for 3.32 machines converted to present worth at 6% interest	10,74,600
	<hr/>
	29,05,459
	<hr/>
	60,90,045

**OWNING & OPERATING COST
DOUBLE SHIFT OPERATION**

DUMPERS*Ownership Cost*

Dep. in 6 yrs. at 25%	•	4,11,011
Interest in 6yrs. at 6% of average annual investment	•	98,643
		<hr/>
for 16.16 machines	•	5,09,654

84,60,250

Operating Cost

Repairs at 75%	•	3,75,000
P.O.L.	•	4,75,200
Labour	•	72,000
		<hr/>
		9,22,200
for 16.6 machines converted to present worth at 6% interest	•	1,24,73,994
Tyres 3 replacements converted to present worth	•	32,59,720
		<hr/>
Total expenditure at present worth for Double Shift Operation	•	2,41,93,964

3,02,84,010

**OWNING & OPERATING COST
DOUBLE SHIFT OPERATION**

SHOVELS*Ownership Cost*

Dcp. in 6 yrs. at 25%	•	8,22,022
Interest at 6% in 6 yrs. of average annual investment	•	1,97,285
		<hr/>
for 2.68 machines	•	10,19,037

27,31,743

Operating Cost

Repairs at 60%	•	6,00,000
P.O.L.	•	6,70,000
Labour	•	2,10,000
		<hr/>
for 2.68 machines converted to present worth at 6% interest	•	14,80,000

32,32,008

59,63,751

DUMPERS*Ownership Cost*

Dep. in 6 yrs. at 30%	•	4,42,000
Interest in 6 yrs. at 6% of average annual investment	•	88,400
		<hr/>
for 13.4 machines	•	5,30,400

71,07,360

Operating Cost

Repairs at 100%	•	5,00,000
P.O.L.	•	5,94,000
Labour	•	1,08,000
		<hr/>
for 13.4 machines at present worth	•	12,02,000

1,31,24,465

Tyres for 4 replacements at present worth	•	32,72,481
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2,35,04,306

Total expenditure at present worth for Three Shifts Operation	•	2,94,68,057
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IDENTIFICATION OF STAND BY COMPONENTS FOR 10 NOs. D-8 H POWERSHIFT TRACTORS

Cost of each Tractor Rs. 7.17 lakhs.

Sl. No.	Part No.	Description of items	Rate Rs.	Total quantity & Amount as per number of shift					Cost of each Tractor Rs. 7.17 lakhs.
				Qty. for I shift Rs.	Amount Rs.	Qty. for II Shift	Amount Rs.	Qty. for III Shift	
1	2	3	4	5	6	7	8	9	10
1.	9H4625	Radiator Group, includes core assembly top & bottom tanks	14,257.64	1	14,257.64	1	14,257.64	2	28,515.28
2.	5M3990	Water Pump	2,688.68	1	2,688.68	1	2,688.68	2	5,377.36
3.	8S6476	Turbocharger Assembly	9,375.56	1	9,375.56	2	18,751.12	2	18,751.12
4.	..	Service Cylinder Head Assembly complete with valves, springs, rotators, chamber assembly, etc.	7,908.15	2	15,816.30	4	31,632.60	4	31,632.60
5.	8A2391	Service Meter Group	591.78	1	591.78	2	1,183.56	2	1,183.56
6.	5M7625	Fuel Transfer Pump Group	1,117.28	1	1,117.28	2	2,234.56	3	3,351.84
7.	..	Fuel Pump Service Group complete with pump assy, bolts, clamps, etc.	7,996.85	1	7,996.85	1	7,996.85	1	7,996.85
8.	1P9340	Oil Pump Assembly	4,464.65	1	4,464.65	2	8,929.30	2	8,929.30
9.	4S9503	Diesel Engine complete with 24v electric starter motor and alternator	1,91,608.65	1	1,91,608.65	1	1,91,608.65	2	3,83,217.30
10.	3S4463	Starter Group (24v)	5,137.97	1	5,137.97	2	10,275.94	3	15,413.91
11.	2S308	Fuel Priming Group	334.51	1	334.51	1	334.51	1	334.51
12.	5S9088	Alternator Assembly	4,134.30	1	4,134.30	2	8,268.60	3	12,402.90
13.	1T670	Torque Converter	16,718.03	1	16,718.03	1	16,718.03	2	33,436.06
14.	1S8754	Universal Joint Assy.	2,356.95	1	2,356.95	2	4,713.90	3	7,070.85
15.	2S7901	Transmission	1,04,131.56	1	1,04,131.56	1	1,04,131.56	2	2,08,263.12
16.	5M6701	Oil Pump Group (Steering clutch & trans. Lub. oil system)	2,509.10	1	2,509.10	2	5,018.20	2	5,018.20
17.	2S7873	Scavenge & Recirculating Pump Group (parts of torque converter)	2,455.15	1	2,455.15	2	4,910.30	2	4,910.30
18.	5M8764	Brake Band Assembly	22,02.80	2	4,405.60	4	8,811.20	6	13,216.80
19.	5H1719	Pump Group (Final Drive)	961.13	2	1,922.26	2	1,922.26	4	3,844.52
20.	..	Idler Assembly complete with shaft, bushing Assembly, seal group, collar etc.	8,421.94	2	16,843.88	4	33,687.76	4	33,687.76
21.	9H6449F	Trunk Roller Group (single flange)	2,231.12	6	13,386.72	12	26,773.33	18	40,160.16
22.	9H6451F	Track Roller Group (double flange)	2,357.70	8	18,861.60	16	37,723.20	24	56,584.80
23.	8M380	Track Carrier Roller Group	1,331.39	4	5,235.56	8	10,651.12	12	15,976.68
24.	7S9116F	Track Group 41 sections and 24" Extreme Service Shoes)	31,440.70	2	62,881.40	4	1,25,762.80	4	1,25,762.80
GRAND TOTAL				5,09,321.98	1	6,79,985.78	2	1,06,038.58	
					7	9			13

Cost of components as percentage of cost of Tractors.
Note:- The rate indicated is based on the present market rate.

STATEMENT SHOWING THE VALUE OF STOCK (SPARE PARTS) RECEIPTS,
ISSUES AND BALANCES

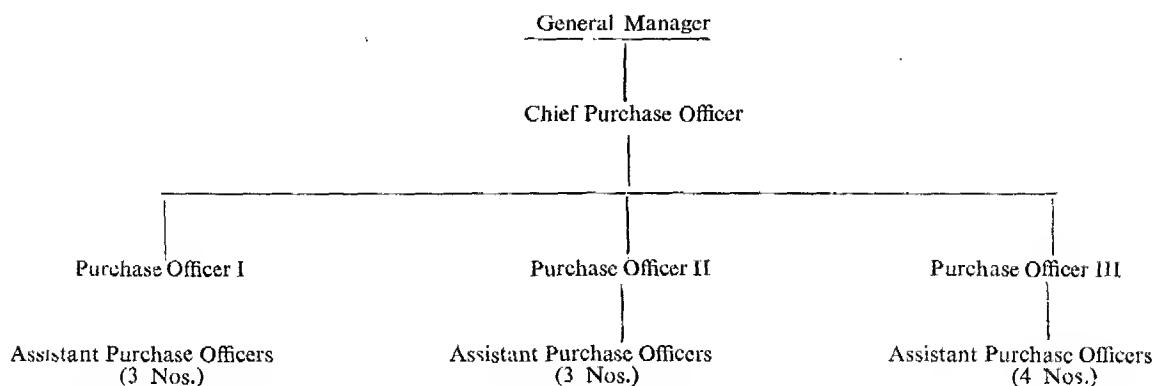
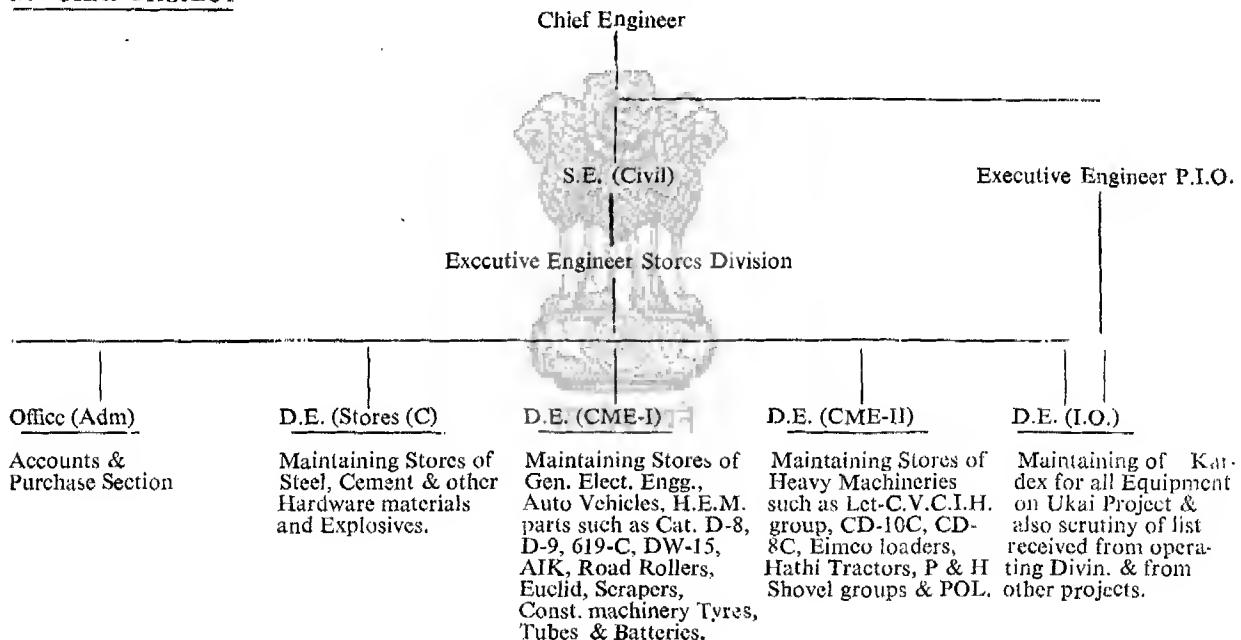
(Value in Rs. Lakhs.)

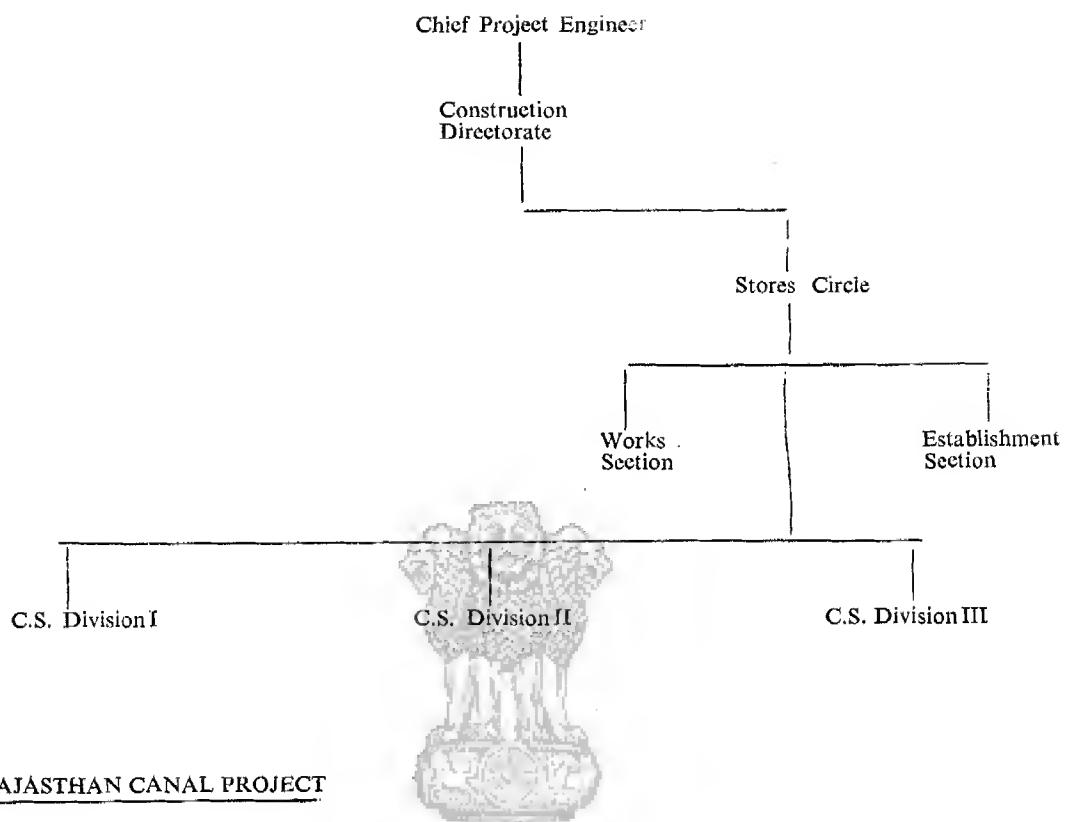
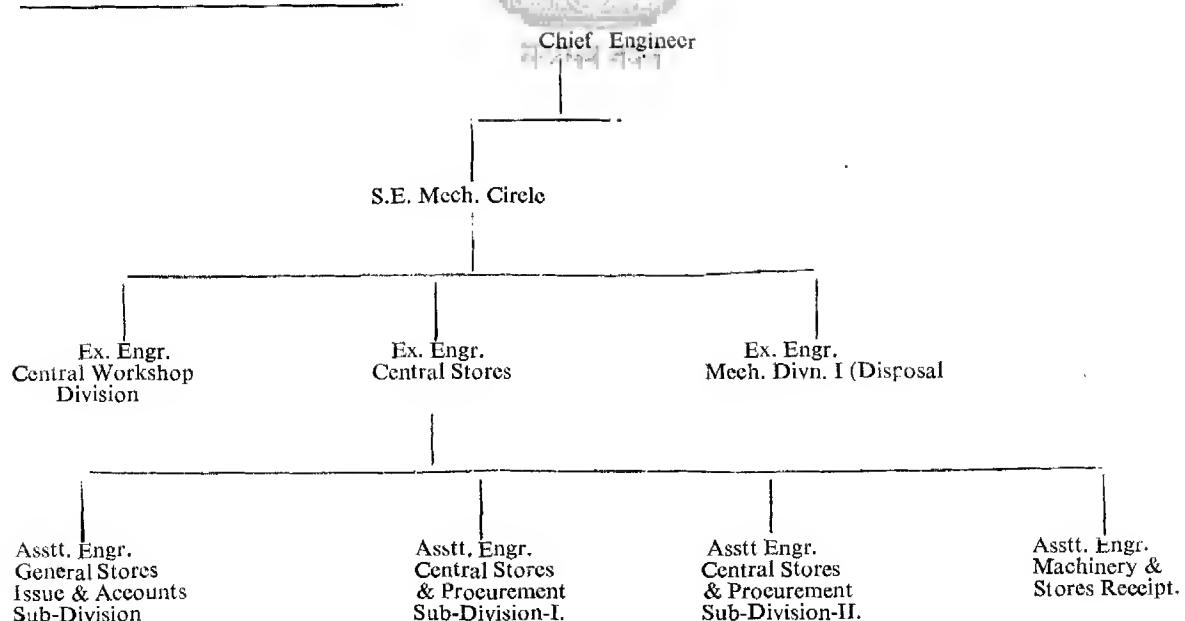
Sl. No.	Year	Value of opening Balance	Value of Stock Receipts	Value of Stock Issue	Value of Balance Stock	Value of New Ma- chines purchased	Value of total m/cs in hand
1	2	3	4	5	6	7	8
1. Beas Project Unit II:							
1965	• • • • •	83·89	66·01	50·72	96·19	55·84	153·03
			43·1%	33·1%	62·9%	,	,
1966	• • • • •	96·19	87·80	50·82	138·17	30·32	183·35
		62·9%	48%	27·7%	75·5%		
1967	• • • • •	138·17	115·97	55·54	198·60	7·27	190·62
		75·5%	60·8%	29·14%	104·18%		
1968	• • • • •	198·60	215·32	93·09	320·82	98·48	289·09
		104·18%	74·5%	32·19%	110·9%		
1969	• • • • •	320·82	191·01	126·47	385·36	544·59	833·68
		110·9%	23·03%	15·2%	46·2%		
1970	• • • • •	385·36	78·75	85·45	378·67	83·97	917·64
		46·2%	8·56%	9·13%	41·2%		
2. Rajasthan Canal Project :							
1966	• • • • •	81·7	33·1	22·3	92·5	..	416·2
		19·7%	8%	5·3%	22·3%		
1967	• • • • •	92·5	13·2	16·3	89·4	..	416·2
		22·3%	3·2%	4%	22%		
1968	• • • • •	89·4	19·8	7·3	101·9	..	416·2
		22%	4·8%	1·8%	24·5%		
1969	• • • • •	101·9	9·4	8·1	103·2	..	416·2
		24%	2·3%	2%	25%		
1970	• • • • •	103·2	17·5	18	102·7	..	416·2
		25%	4·1%	4·3%	24·8%		
3. Farakka Barrage Project:							
1968-69	• • • • •	45·73	31·01	12·72	64·02	..	342·48
		9%	3·7%	18%			
1969-70	• • • • •	64·02	20·61	12·63	72·00	..	342·48
		18%	6%	3·6%	21%		
1970-71	• • • • •	72·00	22·48	13·83	80·65	..	342·48
		21%	6·5%	4%	23·7%		

1	2	3	4	5	6	7	8
4. Ramganga Project :							
1966-67	.	130	68	10	188	221.92	409.92
			16.5%	2.4%	45.8%		
1967-68	.	188	115	27	276	5.01	414.93
		45.8%	27.7%	6.5%	66.5%		
1968-69	.	276	209	78	407	123.70	538.63
		66.5%	39%	14.4%	75.5%		
1969-70	.	407	194	121	480	176.71	715.34
		75.5%	27.1%	16.9%	67.1%		
5. Ukai Project:							
1966-67	.	54.00	113.3	45	122.3	170.75	494.46
			22.6%	10%	25%		
1967-68	.	122.3	157.5	59.3	220.5	161.35	565.81
		25%	24.3%	9%	33%		
1968-69	.	220.5	197.6	174.8	243.3	90.26	746.07
		33%	26.5%	23%	33%		
1969-70	.	243.3	151.7	187.5	207.5	78.87	824.94
		33%	18.4%	23%	25%		
1970-71	.	207.5	161.4	168.7	200.2	..	824.94
		25%	19.5%	20%	24%		

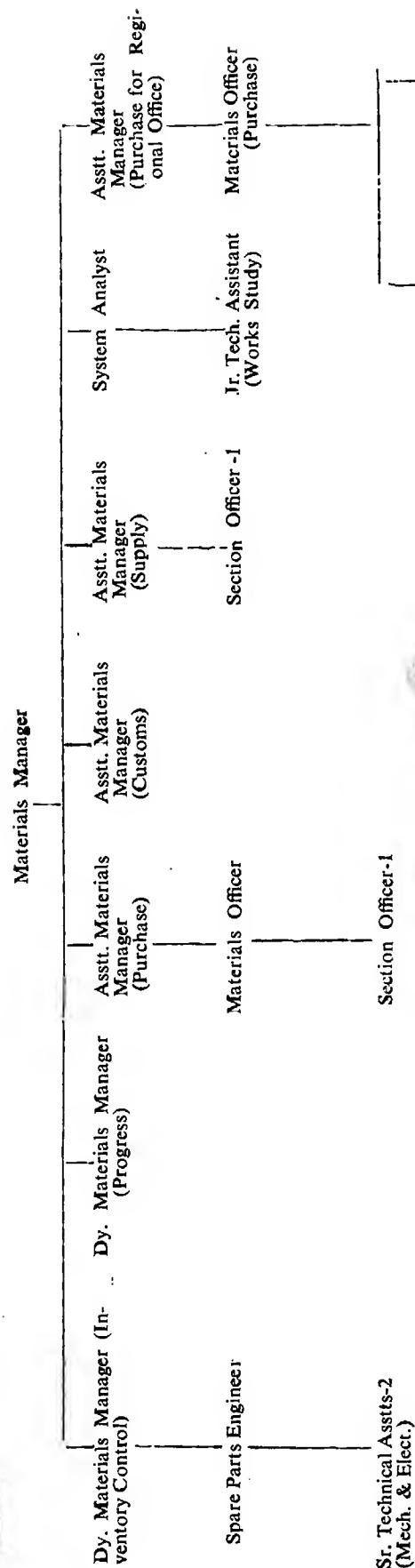


नियमित रूप से

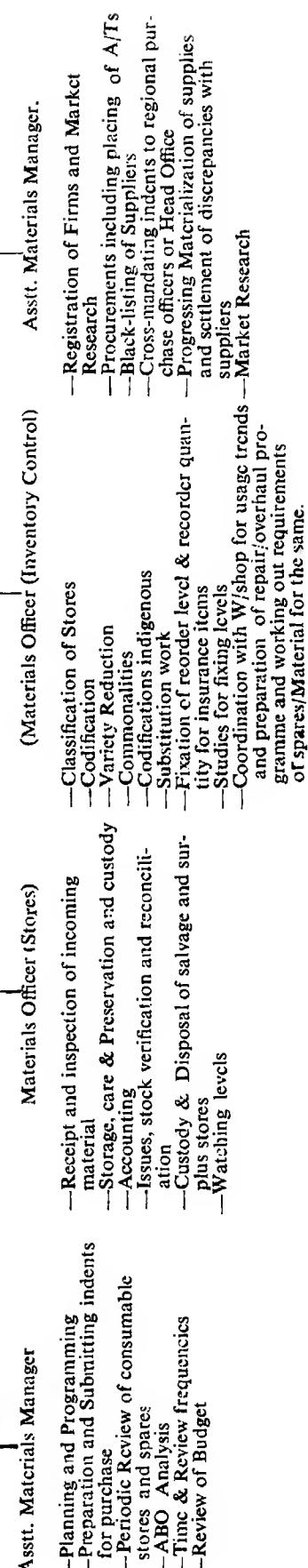
ORGANISATION SET UP WITH SOME USERS OF EQUIPMENTI. BEAS PROJECTII. UKAI PROJECT

II. RAMGANGA PROJECTIV. RAJASTHAN CANAL PROJECT

V. N.M.D.C. (Head Office)



VI. N.M.D.C. (Balladila & Kiriduta)



USE OF KARDEX CARDS FOR INVENTORY CONTROLS

There are two main cards for record keeping of inventory. The *stock card* reflects the day to day transactions of the items and generates historical data for inventory control. The history card stores the consumption and other data in a condensed form. The details are given below.

A. Stock Card—see specimen. The various columns are filled as below ;

1. Card No.—Cards for each item are numbered to simplify filling after they have been completely filled. The suffix A is used for the front side and the suffix B for the back side, such as 1A, 1B, 2A, 2B etc.
2. Sources of Supply—The source from which replenishment stocks are to be ordered.
3. Lead Time—The average number of months required to replenish stock (including a safety margin) as explained later.
4. Maximum Level—The maximum number of pieces that should be on hand and on order at any given time.
5. Minimum—The average number of pieces required to satisfy projects demands during the lead time period.
6. Part No.—Stock Record Cards are usually filed in drawers or boxes after they are removed from the active file. Part numbers are placed on the top of the card to simplify filling.
7. Date—The date of such transaction.
8. Reference—Information which will identify each transaction, such as; purchase order numbers, sales order numbers etc.
9. On Order—Quantities ordered.
10. Receipts—Quantities received.
11. Issues—Quantities ordered by customers, Branch stores, service or sales Departments etc.
12. On Hand—The number of pieces currently in the parts store-room ready for sale.
13. Due Project—The quantity unfilled against the demand from the project.
14. Total Available—This column is one of the most important features of the Stock Record Card. This feature, often lacking in other systems, is invaluable for accurate, realistic control since it reflects the sum of the quantities on hand and on order which is essential for proper ordering.

When the amount in this column reaches the minimum established, additional stock should be ordered.

The figures in this column serve to verify the accuracy of issue and receipt postings, because the total of the figures in the On hand and On order columns should always equal the Total Available figure. When these figures do not agree, a posting error has been made and the card should be audited and corrected promptly.

15. Total Demand—An accumulation of the total *demand* of customers for three month periods. At the end of each calendar quarter the final figure is transferred to the History Card. This eliminates considerable clerical work spent totalling individual figures at the end of each quarter.
16. Part No.—The number of the part being controlled.
17. Name—The Numerical parts Record name of the part being controlled.
18. Cost Price —The price per unit including tax etc.

History Card—see specimen. The following information is recorded on History cards ;

1. Part No.—The part number in this space is used to simplify filling when cards become inactive.
2. Part No.—The number of the Part being controlled.

3. Description—The Numerical Parts Record name of the part.
4. Where Used—That portion of a machine (transmission, final drive, oil pump, etc.,) on which the part is used. This information may be obtained from column No. 4 of the Numerical Parts Record.
5. Replaces—Part number or numbers of preceding part or parts, provided the part being controlled *replaces* a former part or parts. (*replaces* means completely interchangeable).
6. Replaced By—The new part number, provided the part being controlled has been replaced.
7. Used On—The various sizes and models of machines on which the part is used.
8. Net Weight—The weight of the part.
9. Quantity Per Package—The number of pieces included in each package as indicated in the Numerical Parts Record. This enables project to place orders for packaged quantities.
10. Remarks—Miscellaneous information such as Import Duty Rates, Import Commodity Classifications etc.
11. Yearly Consumption—The historic record of past demand. Total demand is recorded each quarter—the information being obtained from the Total Demand column on the related Stock Record Cards.

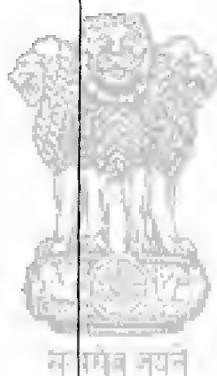
This record of quarterly and yearly demand, while serving as the basis for establishing proper Minimums, also provides information of sales trends so necessary for forecasting stock requirements.



FRONT SIDE

A -- STOCK CARD

Card No. (1)	Source of Supply (2)	Lead Time (3)	Maximum Level (4)	Issues (11)	On hand (12)	Due Project (13)	Tot. Available (14)	Minimum Level (5)	Part No. (6)
19 (7)	Reference (8)	On order (9)		Receipts (10)					
Day No.	Brought Forward								
Part No. (16)	Name (17)							Selling Price (18)	Location

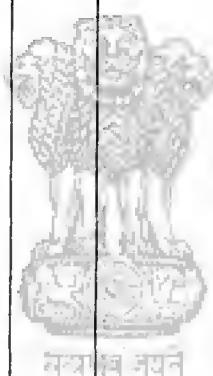


B—HISTORY CARD

BACK SIDE

Part No. (1).....

Part No. (2)	Description (3)
Replaces (5)	Replaced by (6)
Where used (4)	No. Used
Net weight LB (8)	Qty. per package (9)
Remarks (10)	Commodity No.



Yearly Consumption (11)

	19	19	19	19	19	19	19	19
1st Qtr.								
2nd Qtr.								
3rd Qtr.								
4th Qtr.								
TOTAL								

KARDEX RECORD FOR PROTECTIVE ITEMS

The record for protective spares is kept in two types of cards as below, at Central Inventory Control:

(a) Equipment specifications card 1A (Front) and 1B.

This contains details of particular type of equipment such as D7, or D6 Bulldozer etc. in each project area.

(b) Protective items cards—2A & 2B. The number of points of use at each project, the number of assemblies and sub-assemblies, their physical location (they may be in any of the project sites but reserved for CIC) etc.

The cards are self-descriptive.

DETAILS OF THE EQUIPMENT AT VARIOUS PROJECTS

1A Front Side.

Project	Nos. including stand by	Manufacturers Serial Nos. (Major Unit)	Year of purchase	Specific features, if any	Project's specifications sheet Nos.
---------	-------------------------	--	------------------	---------------------------	-------------------------------------



Total Card prepared on.....

Units Revised on.....

EQUIPMENT SPECIFICATION CARD

1A Front Side.

1B back side

SUPPLIERS

CATALOGUE REFERENCES

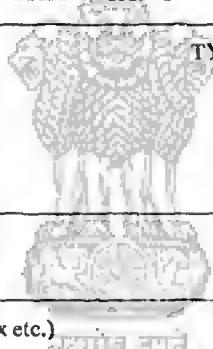
ANY OTHER USEFUL INFORMATION; (Details of drive belts, cross reference of card numbers of connected machinery etc.)

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EQUIPMENT SPECIFICATION CARD

MAKE(Major Unit)

TYPE(Major Unit)



H.P.

SIZE

OUTPUT

MAKE OF SUB UNITS (Engine, Motor, Gear Box etc.)

TYPE OF SUB UNITS

DESCRIPTION

USED FOR

CARD NO

STORES REF.

NAME OF MACHINERY

EQUIPMENT SPECIFICATION CARD

1B Back Side

2A Front Side

RECORDS OF RECEIPTS AND CONSUMPTION

Date Ref. No.

RECEIPT
QTY. VALUECONSUMPTION
QTY. VALUEPOOL BALANCE
QTY. VALUE

... Fold here

CENTRAL INVENTORY CONTROL CARD

INDENT AND ORDER RECORD DELIVERY PERIOD..... MONTHS

INDENTED			PURCHASE ORDER			RECEIPTS		SUPPLIERS	
Date	Indent No.	Qty.	Date	Order No.	Qty.	Due Date		Date	Qty.

DRAWING OR PART NO. SPECIFICATION

REF. No. UNIT..... APPROX. UNIT COST RS..... IMPORTED/INDIGENOUS
ESP/

DESCRIPTION

CIC EMERGENCY STOCK CARD

2A. Front Side.

(2B Back Side.)

STOCK PARTICULARS

PROJECT

No. of points of use.

Allocation

CIC Stock on

LATEST STOCK POSITION AND MOVEMENT PARTICULARS.

(Fold here)

PROJECT

No. of points of use

Allocation

CIC Stock on

T—Transfer
C—Consumed
R—Receipt

Latest pool Stock from Date

CIC EMERGENCY STOCK CARD
(2B Back Side)

ABSTRACT OF REQUIREMENTS DURING THE 5TH PLAN

	Department	Nos.	Value in Rs.lakhs.
1.	Irrigation and Power Sector	2731	13894.40
2.	Govt. Undertakings/Corporations	718	7789.25
3.	Other Government Departments	178	366.90
4.	Private Bodies	79	381.25
	Grand Total	3706	22,431.80

Note :—Details may be seen on subsequent pages.

1. IRRIGATION AND POWER SECTOR

1	Equipment & Capacity	Requirement in Nos.	Cost	Unit	Value in Rs. lakhs.			
			2	3				
1. ANDHRA PRADESH								
<i>Krishna Godavari Delta Drainage Scheme.</i>								
Dredgers 11"	3	80.00		240.00			
18" Cutter Suction Dredgers	2	90.00		180.00			
Grab Dredgers 2.5 Cyds.	3	80.00		240.00			
<i>P.W.D.C.E. Major—Irrigation Hyderabad.</i>								
Komatsu D—120 250 H.P.	12	6.00		72.00			
Tractor/Dozer	1	4.00		4.00			
Scraper 14 Cyds.	9	6.00		54.00			
		30			790.00			

2. BIHAR

C.E. Civil Const.—Investigation Circle, Ranchi.

Scrapers (M)	. . . . .	30	6.00	180.00
Tractors 175 H.P.	. . . . .	10	4.00	40.00
Water Tanker 1000G	. . . . .	8	0.70	5.60
Tractors 175 H.P.	. . . . .	6	4.00	24.00
Shovels 2.5 Cu. Yds.	. . . . .	2	10.00	20.00
Dampers 14.8 Cu. Yds.	. . . . .	8	6.00	48.00
Motor Graders 115 H.P.	. . . . .	2	2.50	5.00
Tractor/Dozer 130. H.P.	. . . . .	2	2.50	5.00
Mucking M/C	. . . . .	1	2.00	2.00
Tractor (Cr.) 60 H.P.	. . . . .	2	1.00	2.00
Mobile Crane 15 T	. . . . .	1	6.00	6.00
		72		337.00

	1	2	3	4
3. GUJARAT				
<i>Kadna</i>				
Tractor Bull Dozers	.	80	2.50	200.00
<i>Ukai</i>				
Tractor Bull Dozer 100 H.P.	.	150	2.50	375.00
		230		575.00

4. HARYANA

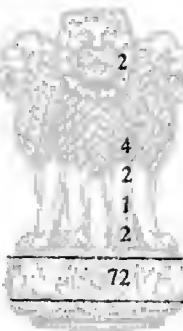
W.J.C. Augumentation

Draglines 2.5 cu. yds.	.	6	10.00	60.00
Do. 1.5 , ,	.	2	8.00	16.00
Tractors .	.	8	6.00	48.00
Tractors (Cr.) .	.	40	6.00	240.00
Graders .	.	2	2.50	6.00
Trailers .	.	1	3.00	3.00
Gantry Crane .	.	2	2.50	5.00

Yamuna Barrage Division

Tractors .	.	2	2.50	5.00
<i>Mech. Drainage Div. Karnal.</i>				
Dragline 1.5 cu. yds.	.	4	6.00	24.00
Tractors 100 H.P.	.	2	2.50	5.00
Motor Grader	.	1	2.50	2.50
Tr. Trailer 30/45 T	.	2	3.00	5.00
		72		419.50

5. HIMACHAL PRADESH

*Baba Hydro (E) Project.*

Shovels .	.	8	10.00	80.00
Loaders (Cr.) .	.	12	3.00	36.00
Do. (Wh.) .	.	6	3.00	18.00
Dumpers (R) .	.	32	6.00	192.00
Graders .	.	4	2.50	10.00
Batching & Mixing Plant .	.	4	12.00	48.00
Transit Mixer .	.	30	4.00	120.00
		96		504.00

6. KERALA

K.I.P. Thenmala.

Tractors (Cr.) 100 H.P.	.	1	2.50	2.50
Pn. Tyred Tractor	.	1	0.80	0.80
Tractor 80 H.P.	.	1	2.00	2.00
Tractor 120 H.P.	.	1	2.50	2.50
Magurt Dumper	.	10	0.80	8.00

1	2	3	4
<i>Idikki hydro</i>			
Shovel 2.5 cu. yds.	1	10.00	10.00
Tractor	1	6.00	6.00
<i>Kanhirapuzha irrigation</i>			
Tractor / Dozer	8	4.00	20.00
Motor grader	1	2.50	2.50
Scrapers	4	6.00	24.00
Dumpers.	7	6.00	42.00
	33		120.00

7. MADHYA PRADESH

Mahanadi Reservoir Scheme

Excavator 2.5 Cu. yds.	4	10.00	40.00
Dumpers 35 T	18	10.00	180.00
Tractors 250 H.P.	9	6.00	54.00
Scrapers 14—18	18	5.00	90.00
Graders	3	2.00	6.00
Tractors 150. H.P.	9	4.00	36.00
Tractors 100 H.P.	12	1.50	50.00
<i>Other Projects</i>			
Excavators 2½ Cu. yds.	14	10.00	140.00
Tractors 100 H.P.	50	2.50	125.00
Do. 250 H.P.	12	6.00	72.00
Dumpers 35 T	24	11.00	264.00
Scrapers 14—18	125	5.00	625.00
Graders 120	18	2.00	36.00
Compactors	19	0.50	9.50
Cranes	6	4.00	24.00
	341		1,769.50

8. MAHARASHTRA

Dumpers 25T	80	6.00	480.00
Tractors 400 H.P.	6	9.00	54.00
Tractors 250 & 175 H.P.	90	5.00	450.00
Shovels 3 cu. yds.	6	10.00	60.00
Loaders 3.5 cu. yds..	6	4.00	24.00
Scrapers 14—18	16	5.00	80.00
Rollers	200	1.00	200.00
	404		1,348.00

1	2	3	4
9. MYSORE			
<i>Hemavathy</i>			
Scrapers 14/20 cu. yds.	.	.	30
Tractor 200 H.P.	.	.	3
Pushers	.	.	4
Tractors 100 H.P.	.	.	6
<i>P.W.D. Irrigation outh Thungbhadrā</i>			
Scrapers 14/20 Cu. yds.	.	.	30
Tractors 300 H.P.	.	.	12
Tractors 180 H.P.	.	.	48
Tractors 100 H.P.	.	.	36
<i>Bochanki Project Hubli</i>			
Tractors (Cr.) 250 H.P.	.	.	2
Tractors	.	.	2
Trailers	.	.	2
<i>Const. of Irr. tank near Bal Kundi Tuluka Hundgund.</i>			
Scrapers	.	.	1
Tractor	.	.	1
	177		755.00
10. ORISSA			
<i>Talcher Thermal</i>			
Tractor/Dozer	.	.	3
Scrapers	.	.	3
Cranes	.	.	2
	8		48.00
11. PUNJAB			
<i>Mech. Drainage Div. Amritsar.</i>			
Draglines	.	.	100
Excavators 2.5 cu. yds.	.	.	18
Tractors (Cr.)	.	.	30
Cranes	.	.	10
Trailers	.	.	2
Batching & Mixing Plant	.	.	2
Screening & Washing Plant	.	.	2
Tractor 250 H.P.	.	.	33
Tractor 120 H.P.	.	.	12
<i>Thein Dam</i>			
Excavators 7 cu. yds.	.	.	2
Do. 4.5 „ „ „	.	.	8
Do. 2.5 „ „ „	.	.	5
Tractor (Cr.) 300—400 H.P.	.	.	20
	30.00	15.00	10.00
	60.00	120.00	50.00
	180.00		

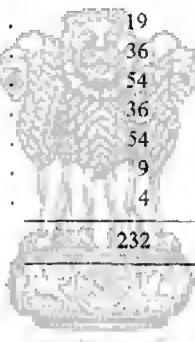
1	2	3	4
Tractor (Cr.) 200—300 H.P.	25	6.00	150.00
Tractor (Wh.)	4	4.00	16.00
Scraper 30 cu. yds.	2	10.00	20.00
Dumpers (R) 20 cu. yds.	30	6.00	180.00
Dumpers (Bottom) 20 cu. yds.	62	6.00	372.00
Craders 125. H.P.	12	2.50	30.00
Cranes	12	6.00	72.00
Truck Tractors	6	3.00	18.00
Trailers	13	3.00	39.00
Mucking/MC 3/4 cu. yds.	5	2.00	10.00
Rocker Shovel 2.5 cu. yds.	10	4.00	40.00
Batching & Mixing Plant	3	12.00	36.00
Transit Mixers	20	4.00	80.00
	358		2,254.00

12. RAJASTHAN

Rajasthan Canal Project

Tata P & H Dragline 3 cu. yds.	10	10.00	100.00
Tractor (Cr.) 100—90 H.P.	10	2.50	25.00
Tractor 50 H.P.	19	1.00	19.00
Tractors (Cr.) 300—400 H.P.	36	9.00	324.00
Tractors (Cr.) 235 H.P.	54	6.00	324.00
Scrapers (T) 30 cu. yds.	36	2.00	72.00
,, 25 Do.	54	1.50	81.00
Tractor (Cr.) 400 H.P.	9	9.00	81.00
F.E. Loaders 2.5 cu. yds.	4	4.00	16.00
	232		1,042.00

13. TAMILNADU

Ponnania Reservoir

Tractor	1	2.50	2.50
	1		2.50

14. UTTAR PRADESH

Maneri Bhali Stage II

Excavators	2	10.00	20.00
Tractors	1	6.00	6.00
Loaders (Wh.)	2	3.00	6.00
Dumpers (R)	25	6.00	150.00
Crane	1	6.00	6.00
Tr. Trailer	4	3.00	12.00
Pneumatic Loaders	5	2.00	9.00
Loco	8	0.80	6.40
Batching & Mixing Plant	5	12.00	60.00
Transit Mixer	8	4.00	32.00
Crushing & Aggregate Plant	2	5.00	10.00

Obra Thermal Extension

Mobile Crane 30 T	1	5.00	5.00
,, 75 T	2	6.00	12.00
Pulling Tr. 100 T	1	4.00	4.00
Pulling with Tr. 50 T	1	2.50	2.50
Diesel Shunter	1	3.00	3.00

1	2	3	4
Sarda Sahayak			
Scraper	9	6.00	54.00
Tractor 250 H.P.	1	6.00	6.00
Do. 150 H.P.	1	5.00	5.00
Do. 80 H.P.	1	1.50	1.50
Do. 250 H.P.	5	6.00	30.00
Motor Graders	3	3.00	9.00
Scrapers	1	6.00	6.00
Tehri Project			
<i>Excavators</i>			
Electric Shovel 4—6 cu. m.	11	25.00	275.00
Diesel Shovel 2 cu. m.	19	10.00	190.00
Trailing Cable for Shovel.			20.00
Tractors 400 H.P.	58	9.00	522.00
Tractors 250 H.P.	14	6.00	84.00
Carriers 35 T Rear.	130	10.00	1,300.00
Tippers	46	0.60	27.60
Loaders 1.25 cu. m.	5	3.00	15.00
Convey mucker	10	3.00	30.00
<i>Compactors</i>			
Vibratory Compactors	15	0.50	7.50
Pneumatic Compactor	3	5.00	15.00
Water Sprinkler	6	6.00	36.00
<i>Drilling & Grouting Equpt.</i>			
Jumbo	1	4.00	4.00
Drifters			7.00
Diamond Coredrill	10	0.50	5.00
Wagon drills	19	0.50	9.50
Drills	22	0.50	11.00
Concrete Vibrators & Grouting Equpt. (Misc.)			
Aggregate Plant			
Processing Plant	1	20.00	20.00
Sand Processing	1	2.00	2.00
Washing & Screening	2	1.50	3.00
Scalping Plant	1	4.00	4.00
Clay Processing	1	2.00	2.00
Concrete Plants			
Water Chilling & Aggregate cooling plant	2	10.00	20.00
Batching & Mixing 200 cum/Ltr.	2	11.00	22.00
Weigh Batchers	6	0.50	3.00
Pump Cretes 40 cum/Ltr.	2	4.00	8.00
Cranes	4	12.00	48.00
Agitating Cars 4 cu. m.	20	2.00	40.00
Dump trucks	4	0.50	2.00
Cement handling			
Handling Plant	2	2.50	5.00
Cement Carriers 10T	4	1.00	4.00
Bucket Elevators 50T	1	0.50	0.50
Transport			
Cement Carrier 16T	17	1.50	25.50
Trailers 40T	1	2.50	2.50
Trailer 20T	1	1.00	1.00
Mobile Servicing Units Road	20	0.60	12.00
Road Maintenance			
Motor graders 130 H.P.	10	2.00	20.00
Water Sprinklers	20	0.80	16.00

1	2	3	4
<i>Cranes & Trailers</i>			
Crane gantry 100T	1	5.00	5.00
Crane mobile 75 T	1	15.00	15.00
" " 50 T	1	8.00	8.00
" " 25 T	2	5.00	10.00
" " 15 T	1	2.50	2.50
" " 5 T	1	1.00	1.00
Trailer with Tractor 100 T	1	6.00	6.00
50 T	4	4.00	16.00
70 T	2	5.00	10.00
	595		3,364.00

15. WEST BENGAL

Kangsabati

Tractor (Cr.) 250 H.P.	1	6.00	6.00
Tractor 250 H.P.	6	6.00	36.00
	7		42.00

*CENTRAL GOVERNMENT / UNION TERRITORIES**Budarpur Thermal Plant.*

Tractor/Dozer 250 H.P.	2	6.00	2.00
Mobile Crane 15 T	1	5.00	5.00
Tr. Trailor 10T	1	3.50	3.50

Chandigarh Capital (P)

Tr. Trailor	2	3.50	7.00
Motor Grader	1	3.00	3.00

I.P. Station

Tractor 250 H.P.	2	6.00	12.00
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Salal Project

Excavators 6 Cu. yds.	4	25.00	100.00
Excavators 2.5 cu. yds.	3	10.00	30.00
Loaders (Wh.) 4 cu. yds.	2	4.00	8.00
Dumpers 25T	57	6.00	342.00
	75		522.50

Grand Total	2731		13,894.40
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ABSTRACT (I. & P. SECTOR)

State	Nos.	Value in Rs. lakhs.
1. Andhra Pradesh	30	790.00
2. Bihar	72	337.60
3. Gujarat	230	575.00
4. Haryana	72	419.50
5. Himachal Pradesh	96	504.00
6. Kerala	33	120.30
7. Madhya Pradesh	341	1,769.50
8. Maharashtra	404	1,348.00
9. Mysore	177	755.00
10. Orissa	8	48.00
11. Punjab	358	2,254.00
12. Rajasthan	232	1,042.00
13. Tamil Nadu	1	2.50
14. Uttar Pradesh	595	3,364.50
15. West Bengal	7	42.00
16. Central Govt./Union Territories	75	522.50
Grand Total	2731	13,894.40

2. GOVERNMENT UNDERTAKINGS / CORPORATIONS

Equipment & Capacity	Nos.	Cost Unit	Value in Rs. lakhs				
				1	2	3	4
1. N.M.D.C.							
Electric Shovel 12/15 Cu. yds.	8	60.00	480.00				
Electric Shovel 4.6 C.M.	24	25.00	60.00				
Tractor Dozers 250 H.P.	64	6.00	384.00				
Dumpers 50 Tons	65	12.00	780.00				
Dumpers 100/120 Tons	6	28.00	168.00				
Dumpers 35 Tons	28	10.00	280.00				
Dumpers 20/25 Tons	6	6.00	36.00				
Motor graders	5	3.00	15.00				
Blast hole drills 9"	24	16.00	384.00				
Blast hole drills 6"	8	9.00	72.00				
Diamond core Drills	10	2.50	25.00				
Percussion Drill Crawler	10	6.00	60.00				
Wagon Drills	7	2.50	17.50				
	265		3301.50				
2. N. C. D. C.							
Shovels 6 Cu. yds.	21	25.00	525.00				
Dragline	3	15.00	45.00				
Dumpers 30/35 Tons	159	11.00	1749.00				
Tractors/Dozers 250 H.P.	39	6.00	234.00				
Blast Hole Drills 9"-12" Dia	26	16.00	416.00				
	248		2969.00				
3. Neyveli Lignite							
Diesel Shovels 1.8 to 2.3 Cu. M.	2	10.00	20.00				
Elect. Shovels 1.8 to 2.3 Cu. M.	1	10.00	10.00				
Tractors/Dozers 250 H.P.	5	6.00	30.00				
Spreader	1	30.00	30.00				
Motor Graders	2	3.00	6.00				
Diesel Dragline 1.8 to 2.3 Cu. yds.	1	10.00	10.00				
Bucket Wheel Excavators 1000 L.	2	70.00	140.00				
	14		246.00				
4. H.S.I.L. Rourkela							
Tractor/Dozers	4	6.00	24.00				
Dumpers	6	6.00	36.00				
Crane Rail	1	8.00	8.00				
Loaders	2	4.00	8.00				
	13		76.00				
5. Land Shaping Schemes (Madhya Pradesh)							
Tractors/Dozers 90 H.P.	50	2.50	125.00				

	1	2	3	4
6. H. S. L. Bhilai				
Shovels 4.6 Cu. M.	.	5	25.00	125.00
Drilling rigs BM 250 mm	.	5	20.00	100.00
Tractor/Dozers 250 H.P.	.	3	6.00	18.00
Dumpers 50 T	.	12	15.00	180.00
Loco Diesel	.	8	3.00	24.00
		33		447.00
7. H.S.L. Barsua Iron Mines				
Dumpers. Haulpak 35 T	.	17	10.00	170.00
Excavators 4 Cu. m.	.	6	25.00	150.00
Excavators 2 Cu. m.	.	2	10.00	20.00
Tractors/Dozers	.	6	6.00	36.00
Churn Drills	.	4	16.00	64.00
		35		440.00
8. Durgri Lime Store Quarry (Orissa Mining Corporation)				
Tipping trucks	.	32	1.00	32.00
Tractor/Dezer	.	1	6.00	6.00
Scraper motorised	.	1	5.00	5.00
Wagon Drill	.	1	1.25	1.25
Loader 2 Cu. yds.	.	1	4.00	4.00
		36		48.25
9. Hirakud Industrial Works (Orissa)				
Crane Crawler 10 T	.	1	4.00	4.00
B. G. Loco 1000 T	.	1	5.00	5.00
		2		9.00
10. Assam Agro Industries Corp (Assam)				
Tractor 60 H. P.	.	6	1.00	6.00
11. Cement Factory & Lime Store Quarry, Meghalaya				
Shovels 1.5 Cu. yds	.	2	8.00	16.00
Dumpers 16 Tons	.	2	4.00	8.00
Tractor/Dozers	.	1	6.00	6.00
Loader 2 Cu. yds.	.	1	4.00	4.00
		6		34.00
12. Daltari Iron Ores Mines, Orissa Mining Corp.				
B. H. Drills	.	3	10.00	30.00
Shovel Elect. 4.5 Cu. m.	.	1	25.00	25.00
Tractors 250 H. P.	.	1	6.00	6.00
Dumper 25 T	.	4	6.00	24.00
Grader	.	1	2.50	2.50
		10		87.50
GRAND TOTAL	.	718		7789.25

ABSTRACT (GOVT. UNDERTAKINGS/CORPNS)

Project	Nos.	Value in Rs. lakhs
1. N.M.D.C.	265	3301.50
2. N.C.D.C.	248	2969.00
3. Neyveli Lignite	14	246.00
4. H.S.L. Rourkela	13	76.00
5. Land Shaping Schemes (M.P.)	50	125.00
6. H.S.L. Bhilai	33	447.00
7. H. S. L. Barsua Mines	35	440.00
8. Dungri Line Store	36	48.25
9. Hirakud Industrial Works	2	9.00
10. Assam Agro Industries	6	6.00
11. Cement factory & Lime Store Quarry, Meghalaya	6	34.00
12. Orissa Mining Corp.	10	87.50
TOTAL	718	7789.25

3. OTHER GOVERNMENT DEPARTMENTS

Equipment and Capacity	Nos.	Cost Unit	Value in Rs. Lakh		
				1	2
				2	3
				3	4
1. GUJARAT					
Office of the Dy. Director of Agriculture, I.A.P. Narasai Tractor 100 H.P.	7	2.50	17.50		
S. E. Agricultural Office, Rajkot Tractor 60 H.P.	35	2.00	70.00		
	42		87.50		
2. KERALA					
Various works B & C Wing — P.W.D. Drilling Plant	35	0.50	17.50		
3. MAHARASHTRA					
<i>Road Development Malbarhill</i>					
Loaders	2	3.00	6.00		
Dumpers	12	3.00	36.00		
Wagon Drills	2	1.00	2.00		
Weigh Batching Plant	1	4.00	4.00		
<i>B & C Sholapur</i>					
Tankers	15	0.50	7.50		
Crushers	6	0.50	3.00		
<i>Kolapa B & C Division</i>					
Water tankers	4	0.50	2.00		
<i>B & C Amravati</i>					
Tractors	4	2.50	10.00		
Crushers	3	0.50	1.50		

	1	2	3	4
<i>B & C Poona</i>				
Crushers		31	0.50	15.50
<i>Mech. Div. Nanded</i>				
Diamond Drilling M/C		3	2.50	7.50
		83		95.00

4. RAJASTHAN

Rajasthan Const. & Transmission

Tractor Tr. 30 T	1	3.00	3.00
Crane 15 T	1	6.00	6.00
	2		9.00

5. TAMIL NADU

Ore Handling Scheme

Bucket wheel Excavator 4000 T	2	50.00	100.00
Reclaimers	1	20.00	20.00
Shovels	2	10.00	20.00
Mobile Crane	1	6.00	6.00
Loco	8	0.80	6.40

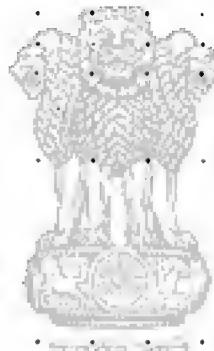
Sheep Farm

Tractor 150 H.P.	1	2.50	2.50
	15		154.90

6. WEST BENGAL

Salt Lake & Dev.

Crane 4 T	1	3.00	3.00
	178		366.90



4. PRIVATE BODIES

1. *Mysore Construction Ltd.*

Trax-cavators 2 cu. yds.	3	3.00	9.00
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2. *Damp Mining Corporation*

Tractor Shovel	1	3.00	3.00
Tractor / Dozer	2	5.00	10.00
Loaders (Wh.)	2	3.00	6.00
Dumpers 15 Tons	10	4.00	40.00
Dumpers 25 Tons	17	6.00	102.00
	32		161.00

3. *Y. M. Salagocar*

Crawler mounted drill with compressor 3½"	1	10.00	10.00
Excavators 2.5 cu. yds.	1	10.00	10.00
Front End Loader (Cr.)	1	3.00	3.00
Wagon Drills	1	1.25	1.25
	4		24.25

	1	2	3	4
4. Emco Pvt. Ltd.				
Loader Wheeled	.	6	3.00	18.00
5. Gurado L. Potcalem				
Loaders (Wheeled)	.	1	3.00	3.00
6. Sallithoorees Pvt. Ltd.				
Shovel	.	3	10.00	30.00
F. End Loaders (Cr.)	.	2	3.00	6.00
Loader (Wh.)	.	3	3.00	9.00
Tractor with Ripper	.	1	9.00	9.00
Tractor D-9 class	.	1	9.00	9.00
Dumpers	.	9	6.00	54.00
Scrapers	.	1	6.00	6.00
Drill with compressor 4½"	.	1	12.00	12.00
Dumpers 15 Tons	.	9	4.00	36.00
Water Tankers	.	2	0.50	1.00
Mobile crane	.	1	4.00	4.00
		33		176.00
GRAND TOTAL	.	79		391.25

EQUIPMENT-WISE REQUIREMENTS DURING THE 5TH PLAN

Equipment/Capacity	I & P Sector	Govt. Undertakings	Other Govt. Deptts.	Private Bodies	Total
1	2	3	4	5	6
1. Excavators					
12/15 Cu. yds.	17	8	..	..	8
4.6 C. M.	17	51	..	..	68
4 C.M.	8	9	..	..	17
1.89 C.M.	108	6	2	4	120
1.5 Cu. yds.	6	2	..	..	8
Dredgers	8	..	..	..	8
Bucket Wheel	..	2	2	..	4
2. Tractors					
300/400 H.P. (Cr.)	129	..	..	2	131
250 H.P. (Cr.)	368	124	..	2	494
150 H.P. (Cr.)	83	..	1	1	85
100 H. P. (Cr.)	368	50	11	..	429
60 H. P. (Cr.)	23	6	35	..	64
Wheeled	4	..	..	..	4
3. Dumpers					
100/12 Tons	..	6	..	..	6
50 Tons	..	77	..	..	77
35 Tons	172	204	..	..	376
25 Tons	301	16	12	17	346
15 Tons	10	2	..	28	40
4. Scrapers (Motorised)					
30 Cu. yds.	92	..	..	..	92
14/18 Cu. yds.	276	1	..	1	278

	1	2	3	4	5	6
5. Front End Loaders, Rock Shovels & Muckers		68	4	2	18	92
6. Motor Graders		57	8	..	..	65
7. Cranes (Crawler, Truck mounted or mobiles)						
75 Tons		3	..	..	..	3
50 Tons		1	..	..	..	1
30 Tons		7	..	..	..	7
15 Tons		34	1	2	1	38
5 Tons		1	..	1	..	2
Rail	1	..	..	1
Gantry		3	..	..	..	3
8. Spreaders	1	..	..	1
9. Tippers		56	32	19	..	107
10. Water Sprinklers		34	..	..	2	36
11. Batching & Mixing Plants		16	..	..	..	16
12. Weight Batchers		6	..	1	..	7
13. Crushing & Aggregate Processing Plants		3	..	40	..	43
14. Pump cretes		2	..	..	..	2
15. Tractor Trailers		38	..	1	..	39
16. Transit mixers		78	..	..	..	78
17. Screening & Washing Plants		4	..	..	..	4
18. Vibratory Rollers		200	..	..	..	200
19. Compactors		37	..	..	..	37
20. Scalping Plants		1	..	..	..	1
21. Clay processing Plant		1	..	..	..	1
22. Water Chilling & Cooling Plants		2	..	..	..	2
23. Sand Processing Plant		1	..	..	..	1
24. Cement handling Plants		2	..	..	..	2
25. Cement Carriers		21	..	..	..	21
26. Bucket elevators		1	..	..	..	1
27. Jumbo drill		1	..	..	..	1
28. Diamond Core drill		10	10	3	..	23
29. Wagon drills		41	8	37	3	89
30. Locos & Shunters		9	9	8	..	26
31. Mobile Servicing Units		20	..	..	..	20
32. B. H. Drills 9"	50	..	..	50
33. B. H. Drills 6"	11	..	..	11
34. Percussion Drills	10	..	..	10
35. Drilling Rigs	5	..	..	5
36. Churn Drills	4	..	..	4
37. Reclaimer	1	..	1
TOTAL		2731	718	178	79	3706

No. 1(3)/62-Policy
Government of India
Ministry of Irrigation and Power
New Delhi, the 18th May, 1964

RESOLUTION

Under this Ministry's letter No. DW, III-28(6)/54 dated the 17th January, 1955 addressed to all State Governments a Standing Committee of Experts was constituted for the purpose of Standardization of important earthmoving and construction equipments and for recommending the Standardised makes of such equipment for use on River Valley Projects under execution or to be executed in further. All River Valley Projects costing more than Rs. 10 crores were represented on the Committee through their Chief Engineers. As the number of such projects had increased and the Committee became unwieldy, the need of revising the basic constitution of the Committee was felt. It was, therefore, decided that the Committee would consist of only one expert from each State and representatives of certain important national undertakings and the concerned Central Ministries.

2. In pursuance of that decision, the Committee is now re-constituted as follows:—

1. Shri M. R. Chopra, Chairman, CW & PC	<i>Chairman</i>
2. Shri A. R. Venkatraman, Member (P & P) CW & PC	<i>Member</i>
3. Shri A. G. Narayanaswamy, Finance Officer, Ministry of Finance (Dept. of Expenditure), New Delhi	Do.
4. Shri B. C. Gangopadhyay, Deputy Secy., Min. of I & P., New Delhi	Do.
5. Shri R. S. Bhalla, Dy. Materials & Plant Officer, Roads Wing, Min. of Transport, New Delhi	Do.
6. Shri N. T. Gopala Iyenger, Development Officer, Deptt. of Technical Development, New Delhi	Do.
7. Brig. K. Sundaram, Director, Technical Planning Principal, Border Roads Organisation, New Delhi	Do.
8. Shri J. S. Mathur, Dy. Director, Office of the D. G. S. & D., New Delhi	Do.
9. Shri B. Parthasarathy, Chief Engineer, (Civil), D.V.C. Maithon, Bihar	Do.
10. Shri D. Mookerjea, Chief Engineer, Farakka Barrage Project, Farakka, West Bengal	Do.
11. Shri K. C. Nayar, Mechanical Engineer, (Planning Division), National Mineral Development Corporation Ltd., New Delhi (1/6 Pusa Road)	Do.
12. Shri B. D. Sahi, Chief Engineer, National Coal Development Corp. Ltd., Ranchi, Bihar	Do.
13. Shri J. S. Jain, General Manager & Chief Engineer, National Projects Construction Corporation Ltd., New Delhi	Do.
14. Shri R. Ramachandra Pillai, Dy. General Manager, Neyveli Lignite Corporation Ltd., P.O. Neyveli-1, Distt. South Arcot, Madras	Do.
15. Shri G. A. Narasimha Rao, Irrigation Adviser, Consulting Engineer & Additional Secretary to the Govt. of Andhra Pradesh, P.W.D. Hyderabad	Do.
16. Shri K. I. Idiculla, Dy. Chief Engineer (General & Projects), Govt. of Kerala, Trivandrum	Do.
17. Shri B. L. Singh, Chief Engineer (Kosi), Patna	Do.
18. Shri S. D. Kadam, Superintending Engineer (Mechanical Organisation), Govt. of Gujarat, Ahmedabad	Do.
19. Shri R. S. Gill, General Manager, Beas Project, Talwara Township, Punjab	Do.
20. Shri S. G. Hiremath, Superintending Engineer, Mechanical Circle, Govt. of Maharashtra, Poona	Do.
21. Chief Engineer, in-charge of Parambikulam-Aliyar Project, Govt. of Madras, Madras	Do.
22. Shri S. P. Singh, Superintending Engineer (Equipment), Govt. of Uttar Pradesh, Irrigation (B) Department, Lucknow	Do.
23. Shri R.A.A. Char, Superintending Engineer, Electrical and Mechanical, Govt. of Madhya Pradesh, Raipur.	Do.
24. Shri Syed Malchuddin Ahmed, Executive Engineer, P.W.D., Govt. of Mysore, Bangalore	Do.
25. Superintending Engineer, Mechanical Circle, Hirakud, Distt. Sambalpur, Orissa	Do.
26. Shri R. C. De, Divisional Engineer (Mechanical) Flood Control Deptt. Govt. of J & K, Srinagar	Do.
27. Shri A. K. Char, Chief Engineer, Ranapratapsagar Dam, Kota, Rajasthan	Do.
Shri Ripudaman Singh, Chief Engineer, (Irrigation), Govt. of West Bengal, Calcutta	Do.
Shri S. P. Chug, Director, (P&M) C.W.&P.C.	<i>Member-Secretary</i>

APPENDIX 7.1

TRAINEES PASSED OUT FROM THE CENTRAL WATER AND POWER COMMISSION - TECHNICAL TRAINING CENTRES FROM THE YEAR 1956 TO 1971 (CENTRE-WISE)

Course	Year of Passing	Sponsored by			Total
		Irrigation and Power Projects	Foreign Countries	Others	
1	2	3	4	5	6
1. Technical Training Centre, Kotah.					
1st.	1956	26	..	..	26
2nd.	1957	35	..	..	35
3rd.	1958	38	..	..	38
4th.	1959	39	..	..	39
5th.	1960	39	..	..	39
6th.	1961	39	..	..	39
7th.	1962	39	..	..	39
8th.	1963	52	1	..	53
9th.	1964	49	..	6	55
10th.	1965	53	..	6	59
11th.	1967	41	..	..	41
12th.	1968	48	3	3	54
13th.	1969	2	..	49	51
14th.	1970	26	..	43	69
15th.	1971	13	1	35	49
		TOTAL	539	5	142
					686
2. Technical Training Centre, Nagarjunasagar Dam.					
1st.	1957	42	..	..	42
2nd.	1958	33	..	..	33
3rd.	1959	40	..	..	40
4th.	1960	37	..	..	37
5th.	1961	38	..	..	38
6th.	1962	40	..	..	40
7th.	1963	35	2	..	37
8th.	1964	50	2	8	60
9th.	1965	51	..	..	51
10th.	1966	57	3	..	60
11th.	1967	52	..	4	56
12th.	1969	26	2	27	55
13th.	1970	4	..	44	48
14th.	1971	19	..	29	48
		TOTAL	524	9	112
					645

	1	2	3	4	5	6
3. Technical Training Centre, Kakrapar.						
1st.	.	1965	54	..	..	54
2nd.	.	1966	56	..	..	56
3rd.	.	1967	48	..	..	48
4th.	.	1968	37	..	..	37
5th.	.	1969	..	..	44	44
6th.	.	1970	6	..	40	46
		TOTAL	201	..	84	285
4. Technical Training Centre, Nangal.						
1st.	.	1964	56	..	..	56
2nd.	.	1965	59	..	..	59
3rd.	.	1966	45	..	11	56
4th.	.	1967	55	..	4	59
5th.	.	1968	55	2	4	61
6th.	.	1969	26	4	23	53
7th.	.	1970	14	3	36	53
		TOTAL	310	9	78	397

YEAR-WISE ABSTRACT OF TRAINEES PASSED OUT FROM ALL THE FOUR CENTRES

Year of passing	Irrigation and Power Projects	Sponsored by		Total
		Foreign Countries	Others	
1956	26	..	..	26
1957	77	..	..	77
1958	71	..	..	71
1959	79	..	..	79
1960	76	..	..	76
1961	77	..	..	77
1962	79	..	..	79
1963	87	3	..	90
1964	155	2	14	171
1965	217	..	6	223
1966	158	3	11	172
1967	196	..	8	204
1968	140	5	7	152
1969	54	6	143	203
1970	50	3	163	216
1971 (upto Sept., 1971)	32	1	64	97
	TOTAL	1574	23	416
				2013

SERVICE TRAINING PROGRAMME AS ORGANISED BY B.E.M.L.

The Service Training Cell in Service Department Commercial Division, has been functioning with the prime objection of imparting training in operation, maintenance, servicing, periodical servicing and adjustments, assembly, dis-assembly and overhauling of various types of equipment which are in our current production programme, to BEML Service Personnel and as well as to the Staff of various customers order to ensure that BEML equipment supplied to customers should be maintained and work satisfactorily.

The Training programmes being organised for the BEML Service Personnel and the staff of the customers; facilities available at BEML factory; and particulars of the syllabus and the instructions are detailed below:

TRAINING PROGRAMMES

A. Training for BEML Service Personnel

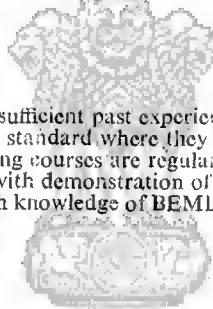
(1) *Experience at the time of recruitment*

The personnel recruited for BEML service set up are mainly Service Engineers and Service Technicians (Servicemen), having requisite qualification and sufficient past experience, in the field of Earth Moving equipment, maintenance, servicing repairs and operation.

The personnel having qualified in Degree/Diploma in Engineering and with a practical experience of 3/7 years in the earth moving equipment are only recruited for the post of Service Engineers and for the post of Service Technicians, the candidates having qualification in Diploma/Trade Certificate courses with practical experience of 1/4 years are being recruited. The matriculates/Non-matriculates are also being employed as Servicemen when they have sufficiently long experience in the practical field.

(2) *Basic and Initial Training*

The personnel so recruited, though having sufficient past experience on Earth moving equipment, are required to be trained on BEML equipment to bring them to such standard where they would be in position to attend to the problems on BEML equipment. Keeping this in view, the training courses are regularly being organised for newly recruited Service personnel for eight weeks on the shop floor of factory with demonstration of all types of equipments and major components in our Production line, to enable them to have thorough knowledge of BEML equipments to attend to the after-sales service when they are posted in the field.



(3) *Advance and Specialised Training*

Besides above basic and initial training courses, the following courses are also being regularly conducted for BEML Service Personnel to give them adequate and specialised knowledge of BEML equipment, and their sophisticated components; the latest developments on them; and their servicing and repairs.

(a) *Training courses conducted by BEML Instructors*

Refresher Training courses are being organised for BEML Senior Service personnel by BEML Training Instructors on particular type of equipment, whenever new type of equipment has been taken up in the manufacturing lines.

(b) *Training courses organised by Sub-supplier of major components*

Service Training courses on major assemblies such as Cummins Engines, Converter-Inverters and Lucas TVS equipments are being organised at the factories of the suppliers of these components for all our BEML Service Personnel in order to give them full knowledge of these components fitted on BEML equipment for attending to the various problems arising on them during operation.

(c) *Training courses conducted by the experts of Foreign Collaborators*

- (i) Training programmes are also being organised at our KGF Works for BEML Service representatives and customers' Staff by inviting the training instructors from our collaborators for one week or a fortnight, depending upon the type of equipment and the number of equipments on which the training is to be imparted.

Three such training courses have been conducted one by WABCO Instructors on Haulpaks Scrapers and Motor Graders for 3 weeks for BEML service personnel and Officers of customers; and two training courses by the Instructors of Radoje Dakic, Yugoslavia for BEML Service Staff; and the Officers and Technicians of Army and DGBR.

- (ii) BEML Service Personnel are being deputed to the factories of our collaborators viz. M/s. KOMATSU, JAPAN; M/s. WABCO, USA and M/s RADOJE DAKIC, YUGOSLAVIA, for advanced training courses in construction, functions, maintenance, servicing and repairs of the equipments and their sophisticated components which are concerned for manufacture under the collaboration agreement.

Some of the BEML representatives had already acquired training on Komatsu Crawler tractors for 2 to 4 months in Japan. Some service representatives are also being deputed to Yugoslavia for training on Tigar tractors for approximately six weeks.

B. Training Programmes for Customers' Staff.

(1) *Training courses conducted at BEML Training Centre*

Service Training Courses are being regularly organised for each type of BEML equipment separately for the Staff of our customers to whom such type of equipments are supplied, in proper operation, maintenance, servicing, preventive maintenance and dis-assembly & assembly of our equipment to enlighten them about all the procedures of the proper maintenance and upkeep of the equipment.

Training courses on Dozers, Haulpak 35 trucks, Scrapers, Motor Graders and Tigar Tractors have been organised for the staff of NCDC, NMDC, ARMY, DGBR, Agro Industries Corporation, Irrigation Projects etc.

(2) *Training Courses conducted at the site of customer*

Service Training Courses are also being organised at the project site of the customers who have bought large number of BEML equipment in order to provide an opportunity to all servicing and operation Staff of customers to participate in the training course with practical demonstration of the machines.

Such training courses have been organised at Bailadila, NMDC, Bhurkunda NCDC, Barsua HSL and DGBR Projects sites for operators and mechanics on Haulpaks, Scrapers, Motor Graders, Dozers and Tigar tractors.

(3) *Training of Engines; Sub-components and Lubricating oils*

Service Training Courses on the major assemblies such as Cummins engine etc. and on lubricants are also being organised for the staff of the customers by inviting the Instructors from the suppliers of these items.

(4) *Training to Operators*

Training for Operators is mainly concentrated on practical operation of various types of BEML equipment, in Dozing, cutting, levelling, grading, loading, dumping etc. Besides practical operation training, the operators are explained and demonstrated the daily and weekly checks; periodical servicing and adjustments and preventive maintenance to enable them to carry the maintenance and servicing in the field by themselves.

SYLLABUS AND INSTRUCTIONS

A. Syllabus

These Service Training Courses have been split into two categories;—

- I. Basic Training Courses.
- II. Special and Advanced Training Courses.

I. Basic Training Courses

The Basic Training Courses for BEML Service Personnel and as well as to the staff of customers are being organised regularly. The Basic Training course covers the instructions and practical demonstration on the following items;—

- (i) Construction and functions of various components of equipment.
- (ii) Servicing, repairs, maintenance and periodical adjustments of the machines and its components.
- (iii) Description of hydraulic systems, electrical systems, air systems etc., and their servicing and adjustments.
- (iv) Practical operation of the equipment.

The Basic Training Courses are being organised generally for one week duration for each type of equipment. This course would enable service personnel to commission the new machines and carryout the periodical servicing and adjustment of the machines and to attend to the repairs, assembly, dis-assembly etc. in the field.

This will also help the maintenance staff of the customers in carrying out preventive maintenance and adjustments.

II. Special and Advanced Training Courses

1. These training courses are organised for some selected service personnel of BEML and senior staff of customers on particular type and model of equipment to make them more specialised in their particular type of machines, such as crawler tractors, scrapers, dumpers and motor graders and wheeled tractors.

2. These courses, would cover major repairs and major overhaul and testing of the engine, torque converter, transmissions (constant-mesh and power-shift), hydraulics suspensions main clutches and differentials and final drives, valves, steering systems etc.

3. Repairs and re-building of under-carriage parts, calibration of fuel injection pumps, hydraulic valves and pumps, testing injectors etc.

4. The duration of this course would be for 3 to 4 weeks.

B. Instructions

The instructions imparted and demonstrations conducted during the training course (Basic) are as follows:-

The theory classes are being conducted in the morning session and the practical demonstration is taken up in the afternoon session for first five days, for one type of equipment, depending upon the convenience.

On the sixth day, there is a general discussion of failures, trouble-shooting and their remedies and precautions to be taken. A test would be conducted on the same day in the afternoon session.

APPENDIX 7.3.1

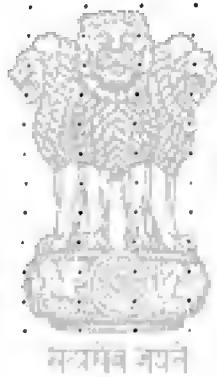
EQUIPMENT & FACILITIES FOR TRAINING OF OPERATORS & MECHANICS ON SHOVELS & DUMPERS

<i>Capital Cost of equipments Components (to be procured from completed Projects at Depreciated Cost)</i>			
(Value in Rs. lakhs)			
Excavators	2 Nos.	@2.0	4.00
Dumpers	8 Nos.	@1.0	8.00
Tractor Dozer	1 No.	@0.50	0.50
Grader	1 No.	@0.50	0.50
Excavator attachment (Shovel, Dragline, Clamshell, Backhoe, Crane)	1 Set		1.00
Wheel Tractor Tanker	1 No.	@0.20	0.20
Trucks	2 Nos.	@0.20	0.40
Audio-visual	1 Set	@0.50	0.50
Sten-Jenny	1 No.	@0.10	0.10
Fueling & Servicing equipment	1 Set	@0.20	0.20
Tools	1 Set	@0.10	0.10
Mobile Workshop	1 No.	@0.20	0.20
Transport vehicle			0.30
<i>Assemblies</i>			
Engine Assembly	4 Nos.	@0.10	0.40
Transmission & Torque Convertors	5 Nos.	@0.10	0.50
Hydraulic Pump Cylinders	2 Sets		0.05
Starting Engine & Compressor			0.05
Tourbo charger, super-charger, Blower			0.10
Fuel Pumps			0.02
Clutch, Dry & Wet			0.05
Under Carriage			0.20
Final Drive & Planetary Drive			0.10
Brake System			0.02
Steering Assembly			0.01
Magneto torque Alternator, Dynamo			0.05
Electric Motor & Controls			0.05
Old Excavators and			2.00
Dumpers			1.50
<i>Workshop Equipment</i>			
Lathe			
Drill			
Grinding			
Milling			
Valve Grinding			2.00
Honing			
Boring			
Fuel Pump Bench			
Crank-shaft grinding			
Engine Stand			
Racks			
Dynamometer			
Work benches &			
Tools			

APPENDIX 7.3.2

EQUIPMENT & FACILITIES FOR TRAINING OF OPERATORS AND MECHANICS ON TRACTORS,
SCRAPERS ETC.*Capital Cost of equipment & components (to be procured from completed Projects at Depreciated Cost)*

		(Value in Rs. lakhs)
Crawler Tractors	10 Nos.	0.7 7.0
Wheel Tractors	4 Nos.	0.5 2.0
Scrapers (Motorised)	4 Nos.	1.0 4.0
Scrapers (Towed)	2 Nos.	0.2 0.40
Tractor Attachments—Dozer Blade, Pushers blade, Excavators loaders, etc.		1.0
Audio-visual	1 Set	0.50 0.50
Steam jenny	1 No.	0.10 0.10
Fueling & Servicing equipment	1 Set	0.20 0.20
Tools	1 Set	0.10 0.10
Transport vehicle		0.30
Trucks		0.40
Assemblies		
Engines	4 Nos.	@0.10 0.40
Transmission & Torque Covertors	5 Nos	0.50
Hydraulic Pump & Cylinders	2 Sets	0.05
Starting Engine & Compressor		0.05
Tourbo-charger, Super-charger, Blower		0.10
Fuel Pumps		0.00
Under Carriage		0.45
Final Drive, Planetary Drive		0.10
Brake system		0.02
Steering Assembly		0.01
Alternators, Dynamos		0.05
P.C.U.s and C.C.U.s		0.15
Electric motors and controls		0.05
Old Tractors & Scrapers		3.00
Workshop Equipment & Tools		2.00
		23.00



APPENDIX 7.4.1

COST OF TRAINING OF OPERATORS

No. of Trainees to be trained per year	120 operators 60 Mechanics. (Value in Rs. lakhs)
A. Ownership & Operating expenses	
Depreciation on Capital Cost with life at 10 years	1.60
Spare parts for repairs	3.40
Operation on expenses & P.O.L. Etc.	1.80
Misc.	0.20
	7.00
B. Establishment	
Jt. Director	Rs. 1500 P.M.
Asstt. Director	„ 800 P.M.
Supervisor	„ 500 P.M.
Instructors	„ 5600 P.M.
Foreman	„ 800 P.M.
Other Clerks etc.	„ 1600 P.M.
	10800 x 12 = 1.30

C. Building

Rent on buildings for School & Hostel or Dep. on building at 40 years life with cost of building at Rs. 20 lakhs	0.50
B+C=Rs. 1.80 lakhs.	
Share of B+C—1.80 lakhs ÷ 180	Rs. 1,000 per trainee
Share of A—7.00 lakh ÷ 120	=Rs. 5,900 per trainee
Total	=Rs. 6,900
Stipend	Rs. 300
Total	Rs. 7,200 per trainee

If the Capital Cost is shared depreciation element on account of Capital cost of equipment and building will not be charged and the expenditure per trainee would be Rs. 5,600/-

If the stipend is also paid by the sponsoring Dept. the expenditure per trainee would be Rs. 5,300/-

APPENDIX 7.4.2.

COST OF TRAINING OF MECHANICS

No. of Trainees to be trained per year—60 Mechanics

A. Ownership & Operating expenses	(Value in Rs. lakhs)
Depreciation with life at 10 years	0.70
Repair parts	0.50
P.O.L.	0.30
Materials	0.60
Misc.	0.30
	2.40
B: Establishment	(as per Operators)
C. Buildings	(as per Operators)
Share of A. 2.40 lakhs ÷ 60	=Rs. 4,000 per trainee
Share of B+C as per operators	=Rs. 1,000 per trainee
Total	Rs. 5,000 per trainee
Stipend	Rs. 1,200
Total	Rs. 6,200 per trainee

If the Capital Cost is shared the expenditure per trainee would be Rs. 4,800.

If the stipend is also paid by the sponsoring Department the expenditure per trainee would be Rs. 3,600.

APPENDIX 7.5

BENEFITS TO BE DRIVEN FROM TRAINING

Considering the actual production figures of some major projects, the average yearly production value of a machine with 2 shifts working is about 30% of its value with an average utilisation of 50%.

This means equipment worth Rs. one crore being utilised only 50% gives a production of Rs. 30 lakhs.

In other words, Rs. 50 lakhs worth of machines, if utilised 100% can produce work worth Rs. 30 lakhs, or the productive value of equipment with 100% utilisation is 60% of its cost per year. However, in practice, the resultant pattern as may emerge may be indicated by quoting the example of Beas Project, where with the 80% utilisation, the value of production is of the order of 43% of cost of equipment.

If average utilisation of equipment can be improved by another 5% through training the personnel on repair, maintenance and supervision, the increase in production will be 3% of the value of equipment per year.

With the present population of equipment valued at above Rs. 300 crores, if the utilisation is increased by 5% of the present utilisation, the extra production that can be achieved will be Rs. 9 crores. The expenditure to be incurred on training the personnel will be about Rs. 40 lakhs pr year, which is only 5% of the extra production that can be achieved from the existing machines by increasing the utilisation by only 5% more.

Considering the Irrigation Projects alone, where the equipment is worth Rs. 100 crores, the increase in production by 5% increase in utilisation will be Rs. 3 crores. The expenditure on training, if taken at Rs. 40 lakhs per year, is only 15% of the increased production.

It may, therefore, be expected that the expenditure that will be incurred on training will be received back many times by increase in production through better utilisation.

Production Value of Machines as obtained at various Major Projects

Project	Value of equipment (Rs. in Crores)	Value of work done during one year (Rs. in Crores)	Average utilisation
Ukai	8.0	3.88	40%
R.C.P.	3.0	0.73	50%
Beas Unit-II	10.0	4.3	80%
Ramganga	8.5	1.26	34%
Balimela	6.21	1.16	30%
	35.71	11.33	50%

APPENDIX 8.1

TECHNICAL DEFECTS NOTICED IN ITEMS OF EQUIPMENT OF DIFFERENT MAKES AND OF DIFFERENT COUNTRIES OF ORIGIN

RUSSIAN EQUIPMENT

(Comments received from Balimela, Farakka, Kharkhara Projects and N.M.D.C.)



1. Belaz 540 Dumpers

- (i) Hoist cylinder piston ring has broken after working about 900 hours.
- (ii) Hydraulic pump hoist cylinder leaks and rings break.
- (iii) Too much of oil consumption in the engine.
- (iv) Due to excessive carbon deposit in the engine the exhaust valves do not function.

2. Maz. 525 Dumpers

- (i) A single spring loaded clutch is very weak even for negotiating light gradients and failure is very common.
- (ii) Consumption of engine oil is very high.
- (iii) Starter is designed to work on 48 volts and requires four heavy duty batteries of 12 volts each.

3. Excavator Model E K G 4.6

- (i) Wear on under-carriage parts appears to be more in comparison to shovels of similar capacity of other makes. Almost all the road wheels (idle) have broken.
- (ii) Wear on the racks of the dipper stick and the pinions is excessive.
- (iii) Holes of the End Casting which connects both the arms of the dipper stick to the bucket become large due to wear and the whole mechanism is to be opened frequently for re-building of the end casting.
- (iv) Excessive wear on the front wall of the bucket.
- (v) Propeller shafts which transmit power to the driving sprocket fail frequently.

4. Russian T-100-M-Tractors.

- (i) These machines are very light and are not suitable for heavy duty work.
- (ii) Under carriage portion is very light.
- (iii) The machines go out of order frequently.

5. Scraper D—357.

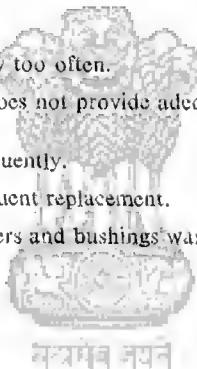
- (i) Injector tips wear out fast.
- (ii) Cracks develop on the sockets holding the injectors.
- (iii) Valve collects slip from the position causing damage to the valves, pistons and engine as a whole.
- (iv) Engine emits smoke even at low RPM.
- (v) Engine gets overheated very soon.
- (vi) Rocker-arm design is faulty causing breakage to the arm.
- (vii) Clutch facings wear out too soon.
- (viii) Frequent damage of hydraulic cylinders, bursting of hydraulic hoses and hydraulic steel pipes.
- (ix) Position of final drive housing not proper to permit tyre replacement by placing a jack below it. Also no guard plate is provided below crankcase to prevent damage to the crankcase.
- (x) Inadequate opening between apron and bowl, causing damage to apron in rocky outcrops.
- (xi) Inadequate stiffening of apron from the inside.
- (xii) No running edges provided on the side of bowl, causing quick wear on sides.
- (xiii) No stiffeners have been provided on the portion of bowls where cutting edge has been fitted.

EQUIPMENT FROM U.S.A.

(Comments received from Rajasthan, Farakka, Ramganga, Gandak, Salandi Projects, J. & K. Flood Control Deptt., N.M.D.C., Neyveli Lignite and H.S.L. Rourkela).

1. Eimco Tractor/Dozer.

- (i) Water pump seal & bearings give way too often.
- (ii) Construction design of the machine does not provide adequate space for attending to repairs and adjustments conveniently.
- (iii) Ring gears are to be changed too frequently.
- (iv) Fan pulley shaft and belt require frequent replacement.
- (v) Quick wear of crank shaft, liners, rollers and bushings was noticed.



2. International Pay haulers.

- (i) Breakage of differential tubes.

3. P & H Excavators.

- (i) Bucket latch keeper and latch bar gives frequent trouble.
- (ii) Breakage of horizontal and vertical propeller shafts.

4. TD-24 & TD-25 Tractors/Dozers.

- (i) Gear box front oil seal leakage is common.
- (ii) C.C.U. is defective.
- (iii) Track rollers and track idlers oil seals leak.
- (iv) Diesel dilution caused by leaky injectors.
- (v) Failure of cylinder heads and gaskets is common.
- (vi) Clutch failure resulting in damage to the pressure plate and cracks on the fly-wheel.

5. Mack Dumpers, L.R.V.S.W.

- (i) 4th. and 2nd gears break very often.
- (ii) Torque convertor oil seal leaks.
- (iii) Gear box front and rear oil seals leak.
- (iv) Insulator caps and bushes of rear suspension breaks or wear out frequently.
- (v) Head gaskets leak and water enters into the oil sump.
- (vi) Steering booster oil seals leak.
- (vii) Battery charging system is not efficient.

6. Cat. 630—B Dumpers.

- (i) The hitch pin and bushes get worn out frequently (after every 1000 hours).
- (ii) All the tyres fitted to these dumpers had developed side wall cracks making unfit for vulcanising.
- (iii) Dump cylinders develop cracks resulting in failure of 'O' rings and leakage of oil.
- (iv) When the engines were opened up for overhaul after 5000 hours of operation, the pistons were found cracked on the top and radially through heat plugs.
- (v) The brake drums of drive wheels of the tractors develop heavy scoring and radial heat cracks and so require replacement after 6000 hours to 7000 hours of operation.
- (vi) Front suspension spring assembly is not able to carry the specified load resulting in breakage of the 2nd and main leaves.
- (vii) Cracks on the dump body and chassis.

7. T.C. ---12 Tractors.

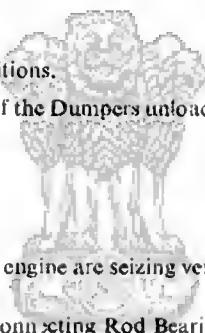
There are no equaliser bar or springs in these tractors with the result that the entire load of the machine comes on the final drive housing. As a result of this the bolts holding the housing to the chassis get sheared and at times damaging the final drives.

8. Mack M—18—X. Dumpers.

- (i) Breakage of steering arms and wear on clutch facing while operating on soft ground conditions.
- (ii) Frequent replacement of hoist P.T.O. due to quick wear.
- (iii) Failure of reverse gear and its bearings in transmission assemblies.

9. Euclid 94—FD Dumpers.

- (i) Failure of clutch under soft ground conditions.
- (ii) Failure of outer hoist cylinder. In most of the Dumpers unloading is not achieved due to these defects on the hoist cylinders.
- (iii) Steering is hard.



10. TD—70 Euclid Rear Dumpers.

- (i) Connecting Rod bearing No. 2 & 5 of the engine are seizing very often resulting in breakage of connecting rod and bursting of engine blocks.
- (ii) Cracks are developing at the crown of connecting Rod Bearings resulting in breakage of bearing shell.



11. Let. B—70 Scrapers.

- (i) Teeth of the ring gears fitted on scrapers break very often (after 100 to 500 hours of run run). In some cases the ring gear has broken into two or three pieces. Still in other cases the ring gears have cracked at the welded joints.
- (ii) The transmission oil gets mixed with final drive oil and vice versa due to the seals preventing mixing of oils are generally damaged.
- (iii) Clutch packs are damaged frequently and out put shafts also break into two pieces.
- (iv) Vanes on dynamic break impeller in torque convertor are breaking frequently. Torque convertor output shafts are also breaking into two pieces.
- (v) As there is no prescribed method for aligning engine and torque convertors the result is that the jack shaft which couple the torque convertor output shaft with final drive, wear out very fast.
- (vi) Generator voltage is poor and the contact points burn out very fast.
- (vii) V-71 G. M. engine fitted on the scrapers are over heating. It is due to the fact that there is no water jacket surrounding the cylinder liners below the air in-take parts.

EQUIPMENT FROM U.K.

(Comment received from Farakka Barrage Project)

1. Foden Dumpers

- (i) Clutch is very weak for the capacity of the machine. Failure is very common.
- (ii) The gear type hoist pump provided fails between 500 to 1000 hours. Hoist trouble is very common.
- (iii) Clearance of differential from ground level is very low, thus the machine is likely to bog down frequently due to less ground clearance.

EQUIPMENT FROM CZEKOSLOVAKIA

(Comments received from Chambal and Salia Projects)

1. **Tatra Dumpers.**

- (i) Leaking of lubricating oil from the cylinder head.
- (ii) Excessive wear of clutch plate facings.
- (iii) Injector nozzles not working satisfactorily resulting in frequent re-calibration.
- (iv) Leakage of oil through tappet covers.
- (v) Leakage of hydraulic fluid due to cracks in hydraulic pipes.
- (vi) Frequent breakage of high and low speed gears.

EQUIPMENT FROM HUNGARY

(Comments received from Salandi Project, C.M.U., Kerala, Ex Engr. D.C.R. Divn. Madras & Perambikulam Aliyar Project).

1. **Mogurt Dumpers.**

- (i) Failure of breaks.
- (ii) Rapid wearing out of clutch facings.
- (iii) Failure of gear shift forks.
- (iv) Leakage due to failure of rubber seals of water pump glands.
- (v) Frequent replacement of piston rings and liners are required. Cracks in cylinder heads.
- (vi) Troubles with C.A.V. fuel injection pump.
- (vii) Frequent failure of metal couplings of fuel injection pump drive.

INDIGENOUS EQUIPMENT

(Comments received from Chief Engineer Balimela, N.M.D.C. Baildihla, Rourkela Steel Plant, Neyveli Lignite and Ramganga Projects).

1. **D-120-6 & 18 Tractors.**

- (i) Before completing 500 hours of operation, the final drive hub of almost all the tractors were found to have been damaged. This is presumably due to the improper fitting of the sprocket nuts at the time of assembling the machines the defect is causing damages to the hub key and bearing of the final drive.
- (ii) Steering drum bolts of almost all the tractors were either found loose or missing even before the tractors had completed 240 hours of run. Excessive wear of steering brake drums and linings.
- (iii) Due to insufficient supply of oil from the clutch oil pump to the hydraulic intensifying mechanism, clutch in the tractors is found hard and the oil is getting heated up.
- (iv) Trackroller seals leaking after working for few hours only.
- (v) Rapid wear on under carriage parts.
- (vi) Diagonal braces of C frame break at welded joints.
- (vii) Engine Water Pump seals and bearings failure.
- (viii) Engine damaged due to valve falling into the cylinder after 16 hours operation.

2. **D-80-8 Tractors.**

- (i) First Gear slips on full load.
- (ii) Excessive wear and tear on the under carriage parts in all the tractors.
- (iii) Frequent break-down of self starter on almost all the tractors even after replacement.
- (iv) 'C' frame of almost all the tractors got cracked at various places.
- (v) Radiator started leaking.
- (vi) Hour meters in almost all the tractors become out of order.
- (vii) Engine main frame cracked near the engine mountings on both sides in some of the tractors.
- (viii) Draw bars in some of the tractors broke.
- (ix) Hydraulic jack seals start leaking.
- (x) Flywheel ring gears get damaged in most of the tractors.
- (xi) Excessive engine oil consumption.
- (xii) Propeller shaft universal joint gives frequent trouble.

3. Haulpak Model LW-35.

- (i) Running repairs of its engine and chassis are on the higher side.
- (ii) Engine cam shaft gears broke. Exhaust valves get damaged oil pressure in most of the machines is low. Wear on tyres has been found much more than that on similar types fitted on pay haulers. Premature failures of engines in many cases.
- (iii) Premature failure of transmission in some cases.
- (iv) Suspension mechanism seals require frequent replacement.
- (v) Failure of Turbo charger system within 1500 hours of service.
- (vi) Hydraulic oil is finding access into the main housing of the self-starter resulting damages to self-starter.
- (vii) There are no dust covers to prevent dust from getting into the dynamo as a result of which the dynamos cease working after some time. Starters in some cases also give trouble.
- (viii) The ampere meter starting switch and solenoid switches are giving constant trouble.

4. Haulpak Model C.F.A.—15.

- (i) Front and rear suspension oil seals leaking.
- (ii) Brake troubles. There is no external arrangement for adjusting the clearance between the brake lining and drum.
- (iii) Trouble in the P.T. pump.
- (iv) Self starter trouble.
- (v) Hoist system not functioning properly.
- (vi) Wheel drums have cracked.
- (vii) Engine fuel system giving frequent trouble after only few hours of operation. Engine not taking load.
- (viii) Exhaust pipe opening is near the airintake filter causing exhaust gas drawn into the air-in-take.

5. Tata P & H—955—A.

- (i) Engine does not take load. RPM drops on load.
- (ii) Excessive heat on torque convertor after a few minutes operation on load.
- (iii) Engine trouble is very common.
- (iv) Propeller brakes do not function efficiently.
- (v) Intermediate swing clutch liners wear out quickly and require frequent replacement.

APPENDIX 8.2

MAXIMUM NUMBER OF HOURS OF OPERATION OF MACHINES, CORRESPONDING TO THE NUMBER OF YEARS THE MACHINES HAVE BEEN IN USE

Name of Project	Equipment	Year of purchase	Hours done from the date of initial Commissioning		
			1	2	3	4
Lakheri Cement	Compressor Bellis Morcan	1937	66000		
Suvarnavathy Project	Tractor Cat. D-4	1946	15420		
Chittargarh Irrigation Division	Tractor III-TD-18	1946	6305		
Lakheri Cement	Dumpers Muir Hill	1946	20000		
Bhakra Nangal	Excavator LB-370	1948	22123		
U.T. Chandigarh	Motorgrader Cat.	1948	25000		
Bhakra Nangal	Dumper Euclid 27--FD	1949	21892		
Tungabhadra	Scrapers Cat. DW—10	1950	2579		
Bhakra Nangal	Tractor Cat. D-7	1950	19420		
Union Territory Chandigarh	Crane-Koehring	1950	10000		
U.T. Chandigarh	Motorgrader Cat. Motorgrader A.W.	1951	25000 14000		

1	2	3	4
Chandarpura Thermal Power Station	Dumper Euclid 70—FDT Dumper Rear Tractor HD—15	1952 1952 1952	1883 814 9943
Sirsi Dam Division	Tractor Cat. D—8	1952	5918
T.I.S.Co.	Crane Lima Mobile 15T	1952	43200
Hissar Bhakra Canal Circle	Motorgrader Cat.	1953	7500
Sirsi Dam Division U.P.	Tractor IH-TD-24	1953	5171
Minor Irrigation Mysore	Tractor Cat. D—6	1953	16280
Bhakra Nangal	Motorgrader Crane Lorain 25T	1953	19176 23289
Suvarnavaty Project	Tractor Cat. D—7 Tractor Cat. D—6	1954 1954	15084 16337
Minor Irrigation Mysore	Tractor Cat. D—6	1954	8541
Elect. & Mech. Division, Raipur	Scraper AC—TS—200	1954	8254
T.I.S.Co.	Crane Neal Mobile 4T Crane Neal Mobile 4T	1954 1954	42000 38600
Rajkot Division	Tractor Cat.	1955	19415
Upper Krishna Project	Motorgrader Bristand	1955	355
Elect. & Mech. Division, Raipur	Tractor Oliver Cletrac	1955	10335
Kandla Port Trust	Crane Rapier 3T	1955	29440
T.I.S.Co.	Loader IH Pay	1955	40000
Lakheri Cement	Dumper Muir Hill Tractor Cat. D—8	1955	30000 37000
Elect. & Mech. Division, Raipur	Tractor TD-9	1956	1983
N.S. Right Canal	Scraper Cat. DW—15	1956	11798
N.C.D.C.	Tractor TD-25	1956	6955
N.C.D.C.	Excavator Lima Dumpers Euclid B1TD Dumpers Euclid B3TD	1956 1956 1956	16438 5142 17824
H.S.L. Bhilai	Tractor HD—21 Tractor TD—24 Scraper (M) AC—TS—360 Motorgrader AC	1956 1956 1956 1956	17369 3489 4337 2539
Chambal Project Rajasthan	Tractor TD—24	1956	15531
Hirapur (UP)	Tractor TD—24	1956	10743
H.S.L. Bhilai	Crane Lime 35 Tons Dozer Let. Dozer Let. Tractor D—120 Hathi	1956 1956 1956 1956	16800 6843 1044 4870
Fertilizer Corp. Nangal	Tractor Cat. D—6	1956	24000
Lakheri Cement Rajasthan	Shovel Marion 93M Dumper Euclid B. 3—FD	1956 1956	33880 22975
Neyveli	Crane Fowler TH. 35T.	1957	33674
N.C.D.C.	Shovel RB—110 Excavator P&H 955 2·5 Excavator EKG8 Russian	1957 1957 1957	34864 15715 5817
H.S.L. Rourkela	Dumper Let. 22 Tons.	1957	30000
Durgapur Steel	Excavator 22 RB 0·75 Cyds. Scrapers Foden 4W Crane John Mobile 5T.	1957 1957 1957	20000 26387 17000
H.S.L. Bhilai.	Tractor (Wheeled) IH—D—650. Tractor (Wheeled) LW—16.	1957 1957	17971 16524
T.I.S.Co.	Crane Hyster 3 Tons.	1957	24000

1	2	3	4
Suvarnavaty Project	Tractor Cat. D-8	1957	20514
Mechanical Drainage Division	Excavator LBK—110	1957	23829
Amritsar	Tractor Cat. D—7	1957	11730
N.S. Left Canal Panset, Pawana, Ujjani	Tractor IH—TD—24	1957	11055
Neyveli	Excavator RB—54 3·5 cyd.	1958	25000
	Tractor Cat. D—8	1958	20408
H.S.L. (Rourkela)	Dumpers Euclid	1958	36400
	Crane IB-Rail 40T	1958	35000
H.S.L. Durgapur	Traxcavator 977	1958	1400
	Crane Coles Truck 27T	1958	21000
	Crane Mobile 22-RB. 10T	1958	16000
	Tractor Trailor 8 Tons.	1958	16600
H.S.L. Bhilai	Excavator Tata PII 955—A	1958	3361
	Excavator Russian C—100M	1958	3489
	Dumper Mack B—81 SX	1958	695
	Crane Crawler Russian 25T	1958	2824
N.P.C.C.	Motorgrader Cat.	1958	1160
Fertilizer Corp. Nangal	Tractor Cat. D—7	1958	22000
T.I.S.Co.	Excavators Menck M—90	1958	32400
	Dumpers Euclid B3FD	1958	36000
	Crane Coles Mobile 12T	1958	33000
	Crane P&H 655B (15T)	1958	30000
	Pay Loader IH	1958	30000
Sesa Goa Pvt. Ltd.	Loader Cat. 977	1958	15127
Lakheri Cement, Rajasthan	Dumpers Euclid B3—TD	1958	20400
Chandrapura Thermal Station, West Bengal	Excavator P&H 955—A	1958	3556
Upper Krishna Project	Scraper C. Roadster	1958	706
	Dumper Rear	1958	4112
Iddiki Hydel	Tractor HD—16	1958	4383
N.S. Left Canal	Excavator N.W.	1958	13772
Panset Project	Tractor IH—TD—24	1958	4618
Mech. Circle, Bihar	Excavator Lima	1958	1028
	Excavator RB	1958	20
D.C.R. Division Tamilnadu	Tractor Cat. D—7	1958	657
N.S. Left Canal	Excavator N.W.	1958	797
	Tractor HD—21	1958	564
	Tractor Cat. D—8	1958	662
	Scraper	1958	140
Ramganga Project	Excavator P&H	1958	780
Ukai Project	Excavator Demag	1958	1281
Iddiki Hydel	Tractor HD—16	1958	736
Panset Project	Tractor IH—TD—24	1958	2748
	Dumper Avlin-Barsford	1958	2470
Giri Hydel	Muck Loader	1959	18470
Mech. Drinage Divn. Amritsar	Excavator Koehring	1959	24657
Hissar Bhakra Canal Circle	Tractor TD—18	1959	7695
Madras Harbour Development	Cranes P&H —655—B	1959	30000
	Cranes Lima	1959	30000
R.R.O.	Tractor Komatsu D—80	1959	4749
	Tractor Komatsu D—120	1959	811
N.C.D.C.	Excavator 110—R.B.	1959	40400
	Excavator P&H	1959	20929
	Excavator Marion	1959	31600
	Tractor Cat. D—8	1959	14266
	Dumper Euclid 46—TD	1959	15615

1	2	3	4
H.S.L. Rourkela	Tractor IH—TD—24 Crane Coles (17T)	1959 1959	30000 20000
H.S.L. Durgapur	Crane Coles (25T)	1959	16450
H.S.L. Bhilai	Crane P&H (50T)	1959	9694
Sesa Goa Pvt. Ltd.	Loader Michigan (Wh.)	1959	13850
Lakheri Cement Rajasthan	Excavator Marion 93-M Dumper Euclid B—3—FD	1959 1959	25850 25990
T.I.S.Co.	Loader Eimco	1959	33000
Bicholim Iron Ore, Goa	Excavator Marion 93-M Tractor HD—11	1959 1959	22000 22000
R.R.O.	Tractor Komatsu Dumper Mack Truck	1960 1960	1911 28001
Madras Harbour Development	Excavator Unikop	1960	25000
N.C.D.C.	Excavator P&H —1600 Excavator Page Walking	1960 1960	27195 31957
H.S.L. Durgapur	Crane RB-38 Dumper Foden 6-W	1960 1960	15989 17244
Sallithoore, Goa.	Dumper Euclid B—7—FD	1960	20000
V.N. Bandeker Goa	Loader Michigan	1960	14520
Sesa Goa	Excavator Lima 604	1960	15190
Mysore Cement Ltd.	Dumper Rear Krup Tractor D—7	1960 1960	5000 10000
Eimco Goa Pvt. Ltd.	Loader Eimco 123—	1960	2907
Hathmati Project Gujarat	Tractor Cat. D—8	1960	10356
Rajasthan Canal	Tractor Cat. D—8	1960	12135
Chandrapally Project	Excavator Skoda	1960	6316
N.S. Right Canal	Excavator Ruston 5W. Walking	1960	5056
Perambikulam Aliyar Project Madras	Tractors Cat. D—7	1960	12135
Rajasthan Canal	Tractors Cat. D—8 IH—TD—25	1960	16520
Ukai Project	Excavators Marion	1960	11842
N.C.D.C.	Excavators P&H (Elect.)	1960	27195
Beas Unit—II	Tractor Cat. D—8	1961	16751
Perambikulam Aliyar Project Madras	Excavators Unieop 150—HP Scrapers Cat. DW—20	1961 1961	5985 15670
	Tractors Cat. D—7	1961	1714
Ukai Project	Tractors Cat. D—8	1961	19046
Rajasthan Canal	Excavators P&H Dragline	1961	14973
R.R.O.	Tractors Komatsu D—120	1961	8989
T.I.S.Co.	Excavators Eimco-105	1961	24000
J&K Flood Control	Excavators 54—RB Dumpers Euclid Tractors Cat. D—8	1961 1961 1961	15536 8608 9331
Neyveli Lignite	Crans IH-660D	1961	43216
H.S.L. Rourkela	Dumpers Euclid D—141	1961	28000
Rajasthan Canal	Scrapers Euclid	1961-62	6005
Kangsabati Project	Tractors Cat. D—8 Scrapers Tournapull 'C'	1962 1962	6340 467
Beas Unit—II	Excavator IEON & Rusting Dumper Euclid B—5—FD	1962 1962	30411 21489
R.R.O.	Tractors Komatsu D—120	1962	480
Haryana Drainage and Flood Control	Excavators Skoda	1962	14000
H.S.L. Durgapur	Tractors D—8	1962	14000
Neyveli Lignite	Excavators 14—RB	1963	8505

1	2	3	4
Beas Unit—I	Tractor Cat. D—8	1963	14081
Beas Unit-II	Excavator B.E. (Elect.)	1963	18412
	Tractor Cat. D—9	1963	17787
	Dumper Euclid B—2—TD	1963	21839
	Dumper Euclid 31—TD	1963	3581
N.P.C.C.	Excavators Hind Marion 93M	1963	9626
N.C.D.C.	Tractors Cat. D—8	1963	17531
	Tractors Cat. D—8	1963	7000
Irrigation Deptt. Punjab	Excavator 38—RB	1963	16660
H.S.L. Rourkela	Crane Lima	1963	20800
H.S.L. Durgapur	Loader Hough	1963	17500
	Dumper Euclid B—2—TD	1964	14446
Beas Unit-II	Excavator 150—B (Elect.)	1964	23318
H.S.L. Durgapur	Tractor Cat. D—8	1964	13000
H.S.L. Rourkela	Tractor TD—25	1964	18200
Balimela Project	Tractor Russian C—100	1964	9128
	Excavator Russian (Elect.)	1964	8769
Ramganga Project	Tractor Euclid C—6	1964	9179
Dandakaranya Project	Tractor HD—21	1965	9748
Mula Project	Excavator Hind Marion	1965	7748
	Scraper Tournapull	1965	8883
Rajasthan Canal	Tractor TD-25	1965	4740
Ramganga Project	Scraper Letourneau	1965	4000
Ukai Project	Dumper Cat. 619—C	1965	8763
N.P.C.C.	Dumper IH-Pay Hauler	1965	6436
N.C.D.C.	Dumper Mack M-30X	1965	12021
Ramganga Project	Dumper Euclid (Bottom)	1966	7896
	Excavator Marion	1966	10165
Ukai Project	Scraper Cat. DW—15	1966	12225
Neyveli Lignite	Tractor Cat. D—8	1966	15595
Beas Unit-II	Tractor Cat. D—8	1967	5159
Mula Project	Tractor Cat. D—8	1967	5390
Giri Hydel	Excavator RB—22	1967	4600
Balimela Project	Dumper Cat. DW—20	1967	3382
Neyveli Lignite	Excavator P&H—955—A	1967	4970
T.I.S.Co.	Dumper Mack M—15X	1967	10000
	Crane Tata P&H 655—B	1967	9000

LIFE OF EQUIPMENT AS ADOPTED BY VARIOUS USERS IN HOURS AND YEARS

Sl. No.	Name of User	Excavators						Tractors		
		Electric			Diesel Elect.	2.5 to 3.5 Cyds.	1.75 Cyds.	Walking Dragline	Above 300 H.P.	Up to 300 H.P.
		7 Cyds	4—6 Cyds.	3 Cyds	7 Cyds	7 Cyds	3.5 Cyds.			
1. Beas Project	• • •	40,000	36,000	33,000	..	25,000	17,000	..	18,000	15,000
2. Ranganga Project	• • •	24,000	..	..	..	10,000	10,000
3. Urai Project	• • •	12,000	12,000
4. Neyveli	• • •	Bucket	Wheel	40,000 (20 yrs)	..	10,000 (7 yrs)	..	10,000 (7 yrs)
5. N.C.D.C.	• • •	36,000 (15 yrs)	30,000 (12 yrs)	..	..	16,000 (8 yrs)	60,000 to (24 yrs)	12,000 (6 yrs)
6. N.M.D.C.	• • •	25,000	..	..	..	..	..	10,000
*7 Min. of Transport	• • •	12,000
8. Parambikulam Aliyar	• • •	12,000	..
9. J & K Flood Control	• • •	15,000	12,000	..	10,000
10. Balimela Project	• • •	40,000	..	..	18,000	..	..	10,000
11. Rajasthan Canal	• • •	22,000	..	..	15,000
12. Yamuna Project	• • •	15,000	12,000	..	10,000
13. Krishna Irrig.	• • •	10,000 (5 yrs)
14. Farakka Project	• • •	15,000	12,000	..	10,000
15. Hindustan Steel	• • •	20,000 (7 yrs)	18,000 (7 yrs)	..	..	18,000 (7 yrs)	..	10,000 (7 yrs)

*Figures taken from the Report of Road Building Machinery of Transport Department.

Sl. No.	Name of User	Dumpers		Loaders	Graders	Scrapers		Cranes mounted	Mobile	Compressors		
		Above 35 Tons	Up to 35 Tons			Motorised	Towed			Stationery Elect.	Diesel Portable	
1.	Beas Project	.	.	20,000	20,000	15,000	..	..	40,000	20,000	40,000	10,000
2.	Ramganga Project	.	.	10,000	10,000	10,000	10,000	..	20,000	12,000	10,000	8,000
3.	Ukai Project	.	.	15,000	12,000	..	..	12,000	..	..	..	..
4.	Neyveli	.	.	..	10,000	..	10,000	..	..	..	..	..
5.	N.C.D.C.	.	.	16,000	12,000	..	..	..	20,000	20,000	20,000	10,000
		(8 yrs)	(6 yrs)						(10 yrs)	(10 yrs)	(8 yrs)	
6.	N.M.D.C.	.	.	..	10,000	..	..	..	10,000	..	..	10,000
*7.	Min. of Transport	.	.	..	12,000	..	15,000	..	..	..	..	10,000
8.	Parambikulam Aliyar	.	.	..	..	..	15,000	..	..	..	..	..
9.	J & K Flood Control	.	.	..	..	10,000	10,000	10,000	10,000	..	..	..
10.	Railmea Project	.	.	..	..	11,000	..	10,000	..	..	..	..
11.	Rajasthan Canal	.	.	..	..	10,000	..	..	..	..	..	..
						(10 yrs)						
12.	Yamuna Project	.	.	..	10,000	..	..	..	..	..	..	..
13.	Krishna Irrig.	.	.	..	..	..	..	..	..	..	..	..
14.	Farakka Project	.	.	..	10,000	..	10,000	10,000	..	20,000	..	10,000
15.	Hindustan Steel	.	.	..	10,000	10,000	10,000	..	10,000	10,000	10,000	10,000
		(7 yrs)	(7 yrs)	(7 yrs)	(7 yrs)	(7 yrs)	(7 yrs)	(7 yrs)	(27 yrs)	(27 yrs)	(27 yrs)	(10 yrs)

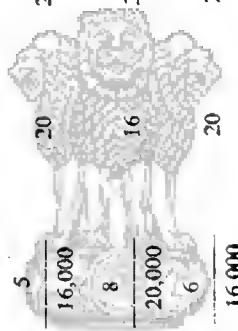
Sl. No.	Name of User	Locos		Belt Conveyors			Workshop equipment	Pile Driving Eqpt.	Drilling equipment		Elect. 10 $\frac{2}{3}$
		Elect.)	Diesel	Structure	Belt	Crushers			Diesel 6 $\frac{1}{4}$ "	Diesel 9"	
1.	Beas Project	..	40,000	10,000	..	..	..	..	..	..	..
2.	Ramganga Project	..	..	..	..	..	..	..	..	..	..
3.	Ukai Project	..	..	..	..	..	..	..	..	..	..
4.	Neyveli	..	..	10 yrs	..	..	..	..	..	..	..
5.	N.C.D.C.	..	..	20 yrs	..	20 yrs	20 yrs	..	12,000 (6 yrs)	16,000 (8 yrs)	20,000 (10 yrs)
6.	N.M.D.C.	..	..	..	..	..	..	..	10,000	..	..
*7.	Min. of Transport	..	..	..	..	..	..	12 yrs	12,000	..	..
8.	Parambikulam Aliyar	..	..	..	..	..	..	..	..	..	..
9.	J & K Flood Control	..	..	..	..	..	..	..	..	..	..
10.	Balimeia Project	..	..	..	..	..	..	..	..	..	..
11.	Rajasthan Canal	..	..	..	..	..	..	..	..	..	..
12.	Yamuna Project	..	..	..	..	..	..	..	..	..	..
13.	Krishna Irrig.	..	..	..	..	..	..	..	..	..	..
14.	Farakka Project	..	..	..	..	..	..	..	7 years for Hammer 10,000 hours for Frame & Vibro Sinker	..	..
15.	Hindustan Steel	..	..	..	..	..	..	..	..	12,000	12,000

*Figures taken from the Report of Road Building Machinery of Transport Department.

STATEMENT SHOWING THE LIFE OF EQUIPMENT, DEPRECIATION PERCENTAGE AND THE REPAIR PROVISION

Sl. No.	Category of Equipment	Life in Years! Life in hours			Depreciation % (Declining balance)			Residual life %	Repair provision during life-time as % of cost		
		Single Shift	Double Shift	Three Shift	Single Shift	Double Shift	Three Shift				
1	2	3	4	5	6	7	8	9	10	11	12
1 EXCAVATORS											
(A) Shovels, Draglines etc.											
(i) Elec. 4 cu. yds. and above											
		22	18	15	10	12.5	15	10	70	100	100
		30,000	40,000	40,000							
(ii) Elec. 2.5 cu. yds. and 4 cu. yds.											
		18	15	12	12.5	15	17.5	10	50	75	80
		22,000	30,000	30,000							
(iii) Diesel 4 cu. yds. and above											
		18	15	12	12.5	15	17.5	10	50	75	80
		22,000	30,000	30,000							
(iv) Diesel 2.5 cu. yds. to 4 cu. yds.											
		12	10	8	16	20	25	10	50	75	80
		15,000	20,000	20,000							
(v) Diesel upto 2.5 cu. yds.											
		10	8	6	20	25	30	10	50	80	90
		12,000	16,000	16,000							
(B) Walking Draglines											
		22	18	15	10	12.5	15	10	70	100	100
		30,000	40,000	40,000							
(C) Bucket Wheel Excavator											
		22	18	15	10	12.5	15	10	70	100	100
		30,000	40,000	40,000							
(D) Dredgers.											
(i) Hull											
		22	18	15	10	12.5	15	10	40	60	70
		30,000	40,000	40,000							
(ii) Machine											
		12	10	8	16	20	25	10	40	60	70
		15,000	20,000	20,000							

1	2	3	4	5	6	7	8	9	10	11	12
2 DUMPERS											
(A) Bottom Dumpers											
(i) Below 20-T											
8 10,000 10 12,000 16,000 20,000											
(ii) Between 20-T and 50-T											
10 12,000 16,000 10 12 15,000											
(iii) Above 50-T											
10 12,000 16,000 10 12 15,000											
(B) Rear Dumpers											
(i) Below 15-T											
8 8,000 10 12,000 16,000 20,000											
(ii) Between 15-T and 50-T											
10 12,000 16,000 10 12 15,000											
(iii) Above 50-T											
10 12,000 16,000 8 10 12,000											
(C) Highway Dumpers											
8 10,000 12,000 8 10 12,000											
3 SCRAPERS											
(A) Motorised (Push loaded)											
(i) Up to 10 cu. yds.											
8 10 12,000 16,000 16,000 16,000											
(ii) Above 10 cu. yds.											
10 12,000 16,000 8 10 12,000											
(B) Elevating & self loaded											
10 12,000 16,000 8 10 12,000											
(C) Towed											
8 10,000 12,000 8 10 12,000											



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(A) Motorised (Push loaded)

(i) Up to 10 cu. yds.

8	6	5	25	30	40	10	80	130	150
10,000	12,000	12,000							

(ii) Above 10 cu. yds.

10	8	6	20	25	30	10	80	130	150
12,000	16,000	16,000							

(B) Elevating & self loaded

10	8	6	20	25	30	10	120	200	240
12,000	16,000	16,000							

(C) Towed

10	8	6	20	25	30	10	40	65	75
12,000	16,000	16,000							

1	2	3	4	5	6	7	8	9	10	11	12
4 TRACTORS											
(A) Crawler											
(i) Upto 100 H.P.	.	.	8	6	5	25	30	40	10	100	160
			10,000	12,000	12,000						200
(ii) Above 100 H.P.	.	.	10	8	6	20	25	30	10	120	200
			12,000	16,000	16,000						240
(B) Wheeled											
(i) Upto 50 H.P.	.	.	8	6	5	25	30	40	10	50	85
			10,000	12,000	12,000						100
(ii) Above 50 H.P.	.	.	10	8	6	20	25	30	10	50	85
			12,000	16,000	16,000						100
5 GRADERS											
			10	8	6	20	25	30	10	50	85
			12,000	16,000	16,000						100
6 LOADERS											
(A) Crawler Loaders	10	8	6	20	25	30	10	120	200
			12,000	16,000	16,000						240
(B) Wheeled Loaders	.	.	10	8	6	20	25	30	10	50	85
			12,000	16,000	16,000						100
(C) Belt Loaders	16	12	10	20	25	30	10	40	60
			20,000	24,000	24,000						70
(D) Reclaimers and stackers . .	.		22	18	15	10	12.5	15	10	40	60
			30,000	40,000	40,000						70
7 COMPACTORS											
(A) Self-propelled sheepfoot Rollers	.	.	10	8	6	20	25	30	10	50	70
			12,000	16,000	16,000						80
(B) Drawn sheepfoot	8	6	5	25	30	40	10	40	60
			8,000	10,000	10,000						70

1	2	3	4	5	6	7	8	9	10	11	12
(C) Vibratory Rollers		8 8,000	6 10,000	5 10,000	25	30	40	10	50	70	80
(D) Smooth Drum Roller		8 8,000	6 10,000	5 10,000	25	30	40	10	50	70	80
(E) Smooth Drum Vibratory Roller		8 8,000	6 10,000	5 10,000	25	30	40	10	50	70	80
(F) Pneumatic tyred Roller		8 8,000	6 10,000	5 10,000	25	30	40	10	50	70	80
(G) Highspeed Compactors		10 12,000	8 16,000	6 16,000	20	25	30	10	50	85	100
8 WATER SPRINKLERS		10 12,000	8 16,000	6 16,000	20	25	30	10	50	85	100
9 DRILLS		10	8	6	20	25	30	10	50	70	80
(A) Blast hole drills		12,000	16,000	16,000	20	25	30	10	50	70	80
(B) Core Drills		8 10,000	6 12,000	5 12,000	25	30	40	10	50	70	80
(C) Wagon Drills		8 10,000	6 12,000	5 12,000	25	30	40	10	50	70	80
(D) Tricone Rotary Drills		10 12,000	8 16,000	6 16,000	20	25	30	10	50	70	80

10 COMPRESSORS

(A) Diesel Compressors:—

(i) Portable upto 300 Cfm.	8 12,000	6 16,000	5 16,000	25	30	40	10	50	70	80
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1	2	3	4	5	6	7	8	9	10	11	12
(ii) Portable above 300 Cfm.	10 12,000	8 16,000	6 16,000	20	25	30	10	50	70	70	80
(B) Elect. Compressors:-											
(i) Portable upto 300 Cfm.	10 12,000	8 16,000	6 16,000	20	25	30	10	50	70	70	80
(ii) Portable above 300 Cfm.	12 15,000	10 20,000	8 20,000	16	20	25	10	50	70	70	80
(iii) Stationery	22 30,000	18 40,000	15 40,000	10	12.5	15	10	50	70	70	80
11 BLOWERS	18 22,000	15 30,000	12 30,000	12.5	15	17.5	10	50	70	70	80
12 COOLING PLANTS	1										
(i) Aggregate Cooling Plant		60,000 hrs. or 20 years.									
(ii) Ice Plant											
13 BATCHING AND MIXING PLANT											
(i) Cement Handling Batching and Mixing Plant.	18 22,000	15 30,000	12 30,000	15	17.5	10	40	65	75		
(ii) Transit Mixers	10 12,000	8 16,000	6 16,000	20	25	30	10	50	85	100	
(iii) Agitating Cars	12,000	16,000									
14 PUMPS											
(i) Diesel, Engine Driven	8 10,000	6 12,000	5 12,000	25	30	40	10	40	60	70	
(ii) Electrical	12 15,000	10 20,000	8 20,000	16	20	25	10	40	60	70	

	1	2	3	4	5	6	7	8	9	10	11	12
15 WELL POINTS			12	10	8							
			15,000	20,000	20,000	16	20	25	10	40	60	70

16 CRANES

(i) Mobile (Pneumatic Wheeled 4 to 6 tons)	10	8	6	20	25	30	10	50	85	100	
8 to 12 tons	12,000	16,000	16,000								
15 to 25 tons	12	10	8	16	20	25	10	50	85	100	
26 tons and above	15,000	20,000	20,000								
(ii) Crawler Mounted upto 3 tons ¹ :	10	8	6	20	25	30	10	50	80	90	
4 to 10 tons	12,000	16,000	16,000								
Over 10 tons	18	15	12	12.5	17.5	10	50	75	75	80	
	22,000	30,000	30,000								
(iii) Tower Crane	22	18	15	15	10.0	12.5	15.0	10	70	100	100
	30,000	40,000	40,000								
(iv) Truck Mounted	10	8	6	20	25	80	10	70	120	140	
	12,000	16,000	16,000								

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17 TRANSPORT EQUIPMENT

(A) Heavy Transport Vehicles.

(a) Trucks:—

(i) Diesel upto 3-T Diesel 3 to 5-T 5-T and above	: : : : : : : : : : : :	2,50,000 K.M.
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(b) Tractor Trailers Upto 5-T 5-T to 10-T	: : : : : : : : : : : :	2,50,000 K.M.
10-T to 25-T 25-T to 50-T 51-T and above	: : : : : : : : : : : :	10

10-T to 25-T	: : : : : : : : : : : :	10
25-T to 50-T	: : : : : : : : : : : :	
51-T and above	: : : : : : : : : : : :	

51-T and above	: : : : : : : : : : : :	
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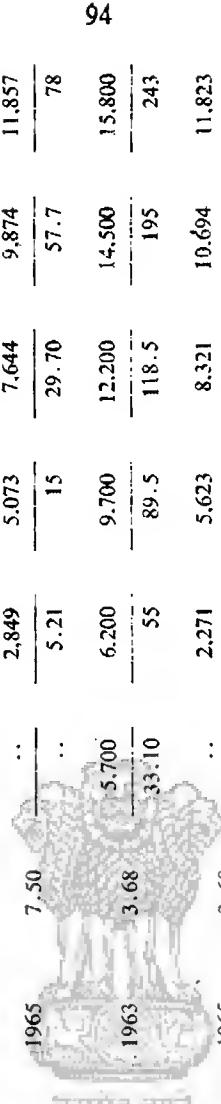


1	2	3	4	5	6	7	8	9	10	11	12
(B) Light Transport Vehicles											
(i) Jeeps	10	10	100
(ii) Station Wagons	1,60,000 K.N.			
(iii) Cars				
(iv) Ambulance Cars				
(C) Arial Transport											
(i) Rope-ways	20 years, 40,000 hrs.	10	10	50
(ii) Cable-ways				
(D) Rail Transport.											
(i) Locomotives:—											
Diesel	10 — 12,000	8 — 16,000	6 — 16,000	20	25	30	10
Elect.	22 — 30,000	18 — 40,000	15 — 40,000	10	12.5	15	10
(ii) Wagons	22 — 30,000	18 — 40,000	15 — 40,000	10	12.5	15	..
(iii) Rail Cars	22 — 30,000	18 — 40,000	15 — 40,000	10	12.5	15	..

REPAIR EXPENDITURES ON MAJOR ITEMS OF EQUIPMENT FOR THE LAST 5 YEARS AS INTIMATED BY SOME OF THE PROJECTS

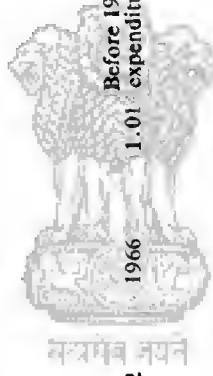
Name of the Project and Category of Machine	Nos.	Year of Purchase	Cost in lakhs	Earlier Years	1965-66		1966-67		1967-68		1968-69		1969-70	
					Hours Worked	Hours Worked	Hours Worked	Hours Worked	Hours Worked	Hours Worked	Hours Worked	Hours Worked	Expenditure	Expenditure
					1	2	3	4	5	6	7	8	9	10
<i>Beas Unit. I</i>														
Shovel 2.5Cyds	1	1966	2.74	..	..	..	947	1,831	3,211	4,216
								3.45	39.53	43.81	48.2	
Shovel 2.5Cyds	3	1964	7.96	..	1,788	2,760	3,477	4,491	5,854	93
								..	2.14	4.34	6.40	7.1	14.7	
Rocker Shovel 1.5Cyds	4	..	2.05	..	388	846	1,109	1,127	1,899	
								..	5.49	10.56	13.20	14.72	16.84	
Tractor Cat. D-8	8	1963	2.60	2.591	5,109	6,643	8,307	9,753	11,189	
								10	12.60	16	16	19	23	28.3
<i>Beas Unit. II</i>														
Shovel Elect. 7 Cyds.	1	1964	19.30	..	4,511	8,629	10,853	14,825	19,818	
								..	4.73	9.67	11.41	24	57.5	
Motor Grader	6	1965	0.80	..	1,806	4,340	6,411	8,143	10,282	
								..	12.76	39	69.3	58.20	165.8	
Tractor Cat. D-8	20	1969	3.90	..	..	..	..	..	2,673	6,302
								1.25	23.9
Tractor Cat. D-8	4	1963	2.33	5,000	7,662	9,888	11,873	14,115	15,136	
								52.5	92.5	139.50	236	286	316	

	1	2	3	4	5	6	7	8	9	10
Dumpers (Reat)	.	.	.	13	1969	4.45	..	..	..	1.102
Loader Front End (Cr)	.	.	2	1966	1.25	..	..	..	1.50	9.38
Dumpers Bottom	.	.	11	1963	2.00	5.700	9.744	13.395	16.523	18.231
Dumpers Bottom	.	.	8	1964	5.72	..	4.283	9.030	13.464	15.907
Dumpers Bottom	.	.	50	1969	5.79	..	8.81	14.65	30	39
Shovels 2.5Cyds	.	.	5	1965	7.50	..	2.849	5.073	7.644	9.874
Tractor Cat.D-9	.	.	4	1963	3.68	5.700	6.200	9.700	12.200	14.500
Tractor Cat.D-9	.	.	5	1965	3.68	33.10	55	89.5	118.5	195
Ramganga										
Shovel 7 Cyds	.	.	1	1966	26.57	2.395	..	..	..	6.395
Ukai										
Shovel Taia P&H 2.5Cyds.	.	.	6	1962	6.70	..	1,096	2,955	4,581	6,194
Scrapers Let.	.	.	32	1957	0.81	..	316	1,363	1,716	1,996
						..	7.9	20.4	47.3	97.9
								..	4.19	12.7
										10.165
										7.947
										86.6
										2.181
										108.91



	1	2	3	4	5	6	7	8	9	10
Scrapers V.C. (New)		45	1967	5.52	..	..	..	306	1,462	3,298
Dumpers V.C. (New)		28	1967	5.38	..	..	..	0.7	2.72	3.67
Dumpers Cat. 619-C		7	1965	2.50	..	..	..	18	592	2,093
Loader Emico (Cr.)		3	1966	0.69	..	1,240	2,756	4,029	5,237	6,683
Tractor Cat. D-9		3	1965	4.13	..	..	763	2,042	3,435	4,931
Tractor Cat. D-8		13	1965	2.23	..	..	21.1	61.2	144.6	208
Motor Grader Galion		8	1958	0.55	..	..	871	2,000	3,041	4,612
<i>Balimela</i>										
Shovel 1.25Cyds.		8	1963	3.15	..	4,876	5,817	6,248	6,437	6,437
Shovel Elect. 4.6Cyds.		5	1965	15.57	..	..	6.8	7.31	7.45	12.46
<i>N. S. Left Canals</i>										
Scrapers Let. 'C'		2	1957	2.02	50	55.38	57.84	61.6	65.3	68
Scrapers Let. 'C'		1965	2.05	..	..	832	2,011	2,831	3,624	4,141
Scraper Let.		10	1963	1.86	5	2,784	4,400	5,550	6,300	7,100
						8.70	14.60	19	24.30	29.2

	1	2	3	4	5	6	7	8	9	10	
Tractor Cat. D-8	.	.	.	1	1958	1.64	1,916	2,501	3,530	3,987	4,102
Tractors Cat. D-7	.	.	.	3	1957	1.67	3,424	4,266	5,012	5,351	6,796
Motor Grader Cat.	.	.	.	1	1965	0.90	..	431	782	826	29.32
Tractors Cat. D-7	.	.	.	2	1958	1.64	2,670	3,516	4,158	5,140	888
<i>Srisailam</i>											
Dumpers Euclid	.	.	.	5	1964	1.04	..	250	450	625	700
Dumpers Euclid	.	.	.	7	1966	1.03	..	300	805	1100	1,395
Tractor TD-24	.	.	.	1	1965	1.65	..	310	1,015	1,778	2,112
Tractor Cat. D-7	.	.	.	1	1964	1.28	..	1,880	2,830	3,940	4,310
Shovel P & H	.	.	.	1	1965	7.25	..	1,300	2,138	2,846	3,334
Perambikulam Aliyar	.	.	.	11	1961	2.34	8,500	9,500	10,100	10,700	11,550
Scrapers Cat. DW-20	.	.	.			60	65	71	76	81	85



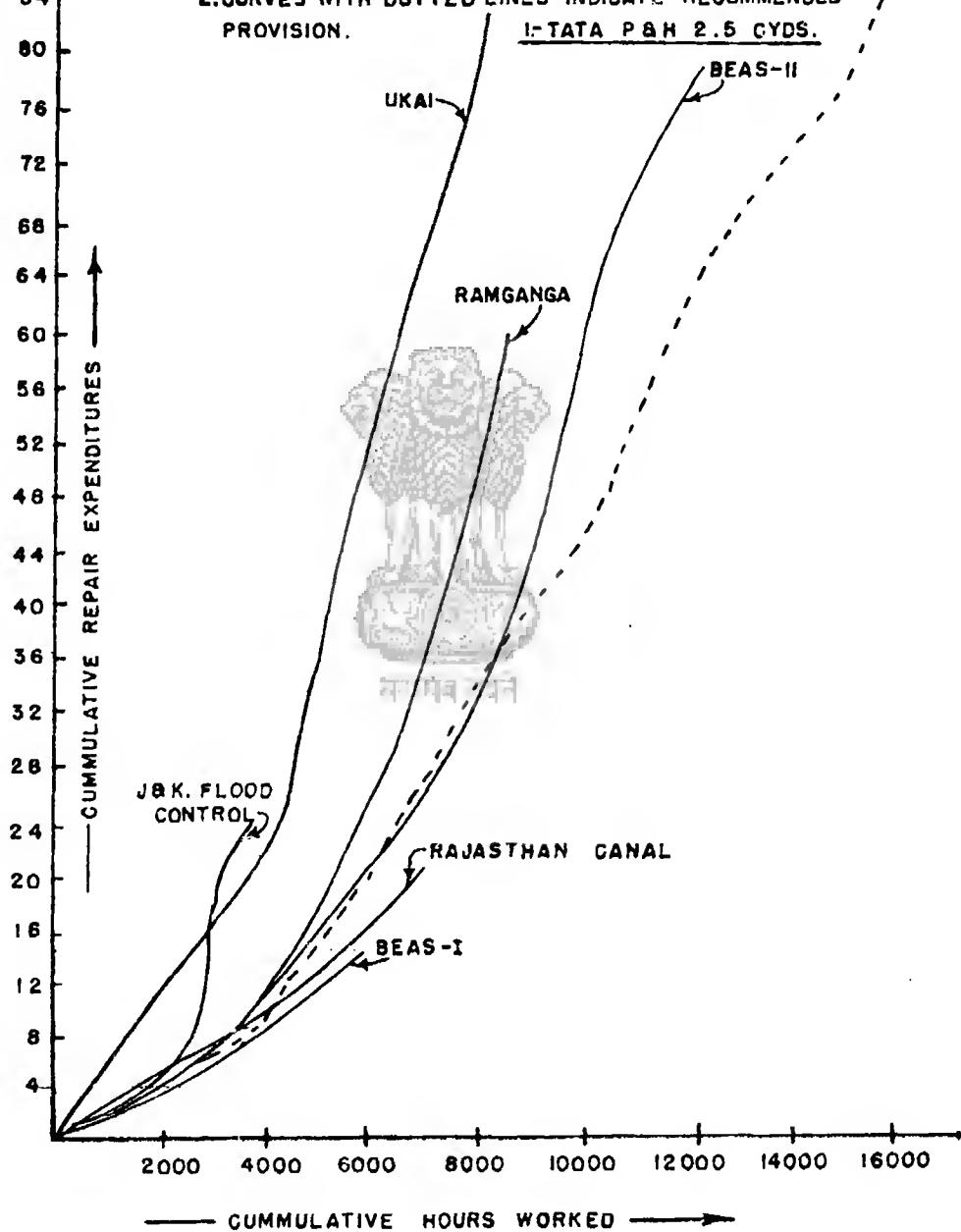
Neveli Lignite

Hindustan Steel Ltd.						
Crane P & H	.	.	.	.	.	.
	4	1964	2.97	**	1,925	3,700
				..	3.10	6.08
						4,300
						4,500
						4,700
						9.3
Tractor Crane	.	.	.	.	.	.
	5	1964	0.42	1,231	3,246	4,264
				2	2.98	3.77
						5,222
						5,480
						5,480
						4.6
						4.89

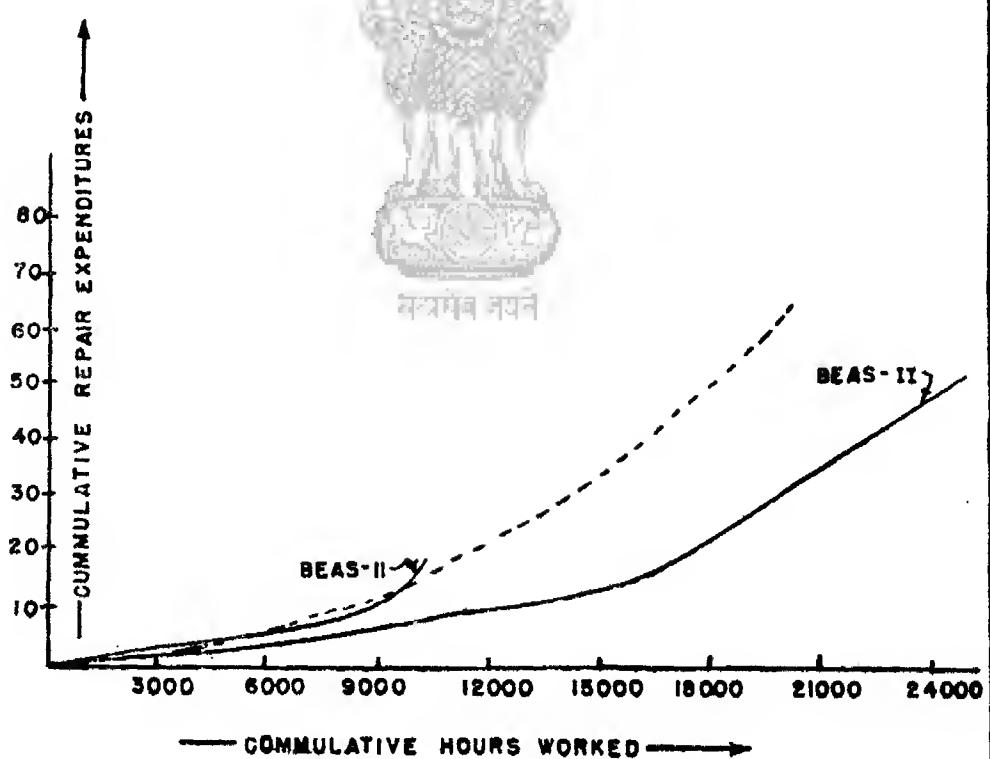
APPENDIX 9.6

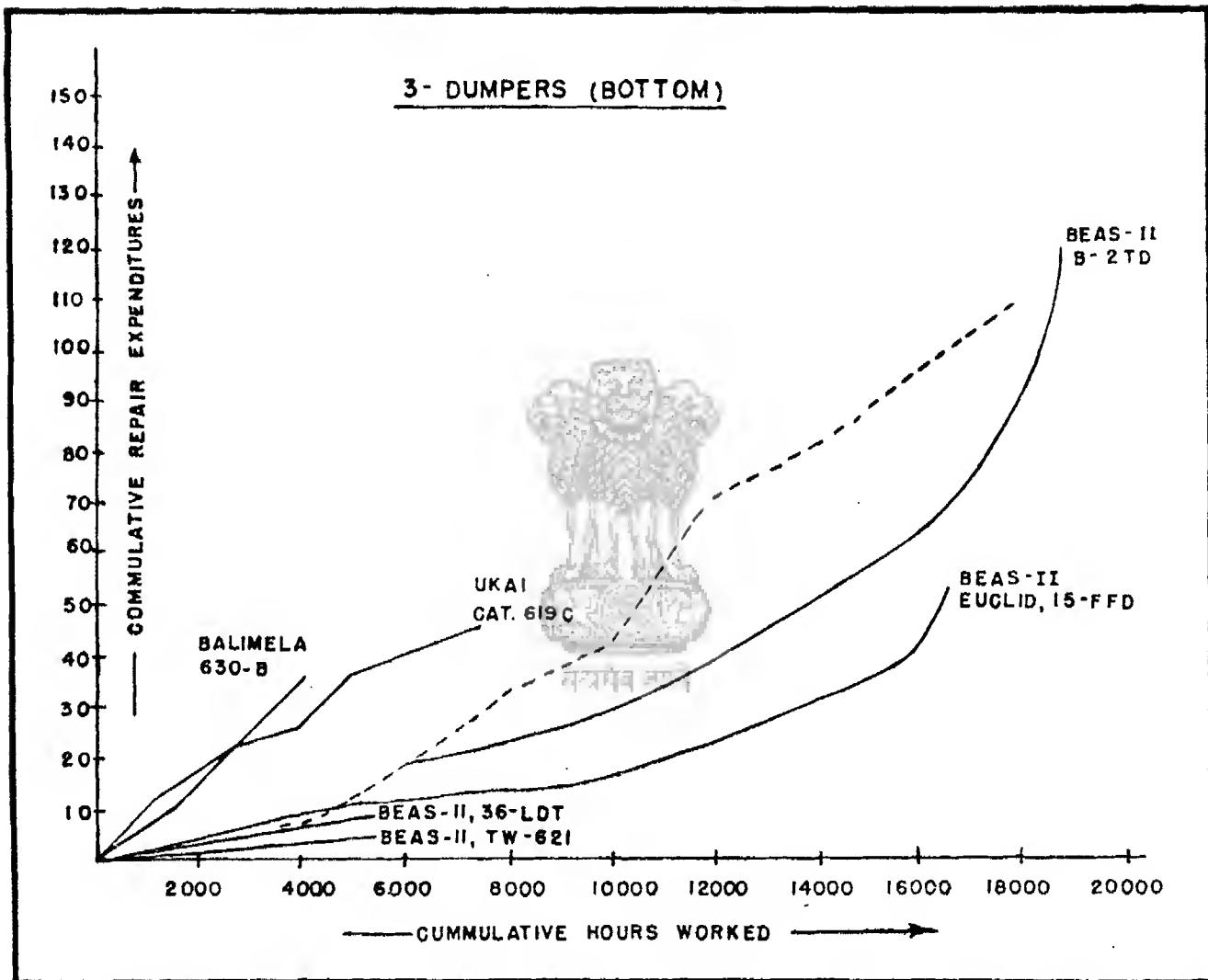
**GRAPHS SHOWING A COMPARISON OF REPAIR EXPENDITURES
WITH DIFFERENT USERS AND THE RECOMMENDED PROVISION**

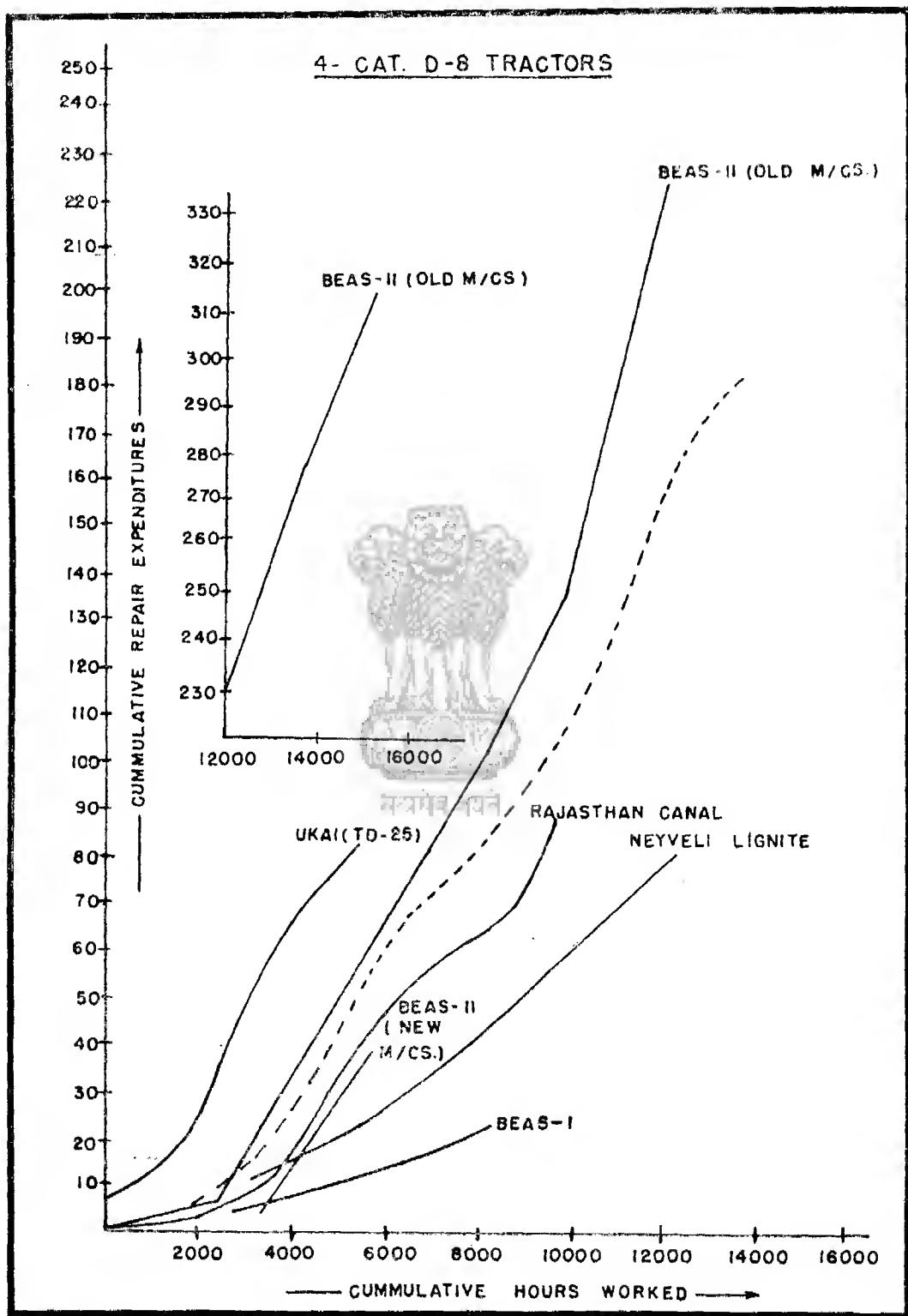
NOTE:-
1. REPAIR EXPENDITURES ARE SHOWN AS % OF COST.
2. CURVES WITH DOTTED LINES INDICATE RECOMMENDED
PROVISION.



2 - ELECTRIC SHOVELS ABOVE 4 CU.YDS



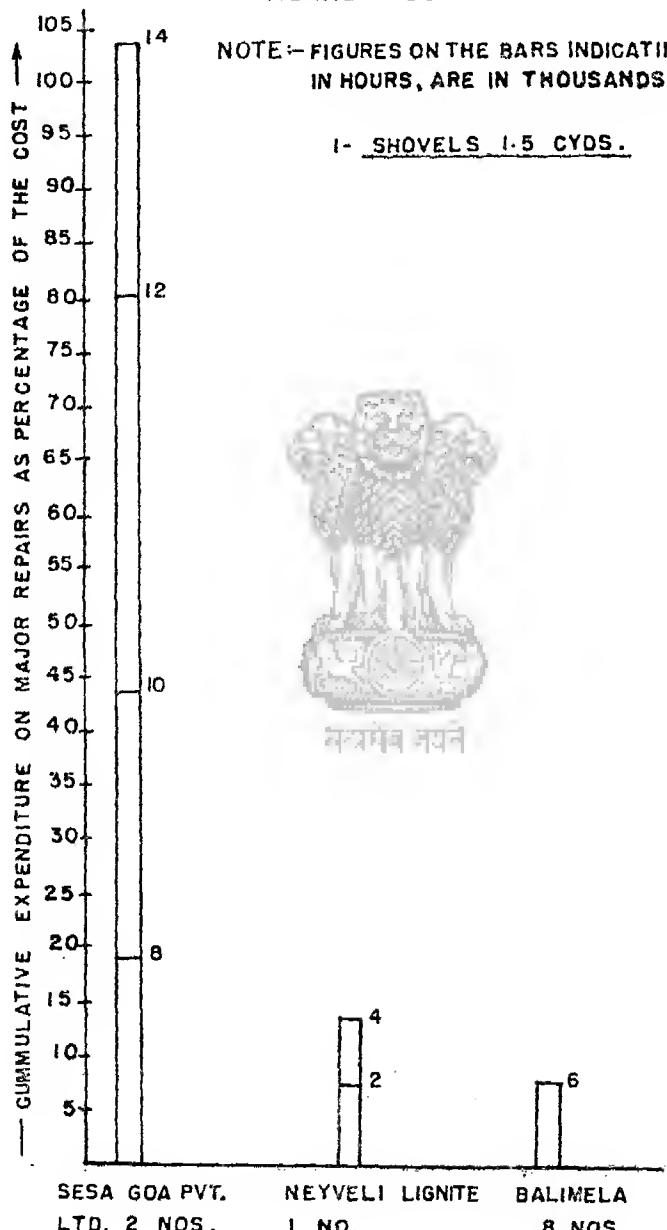




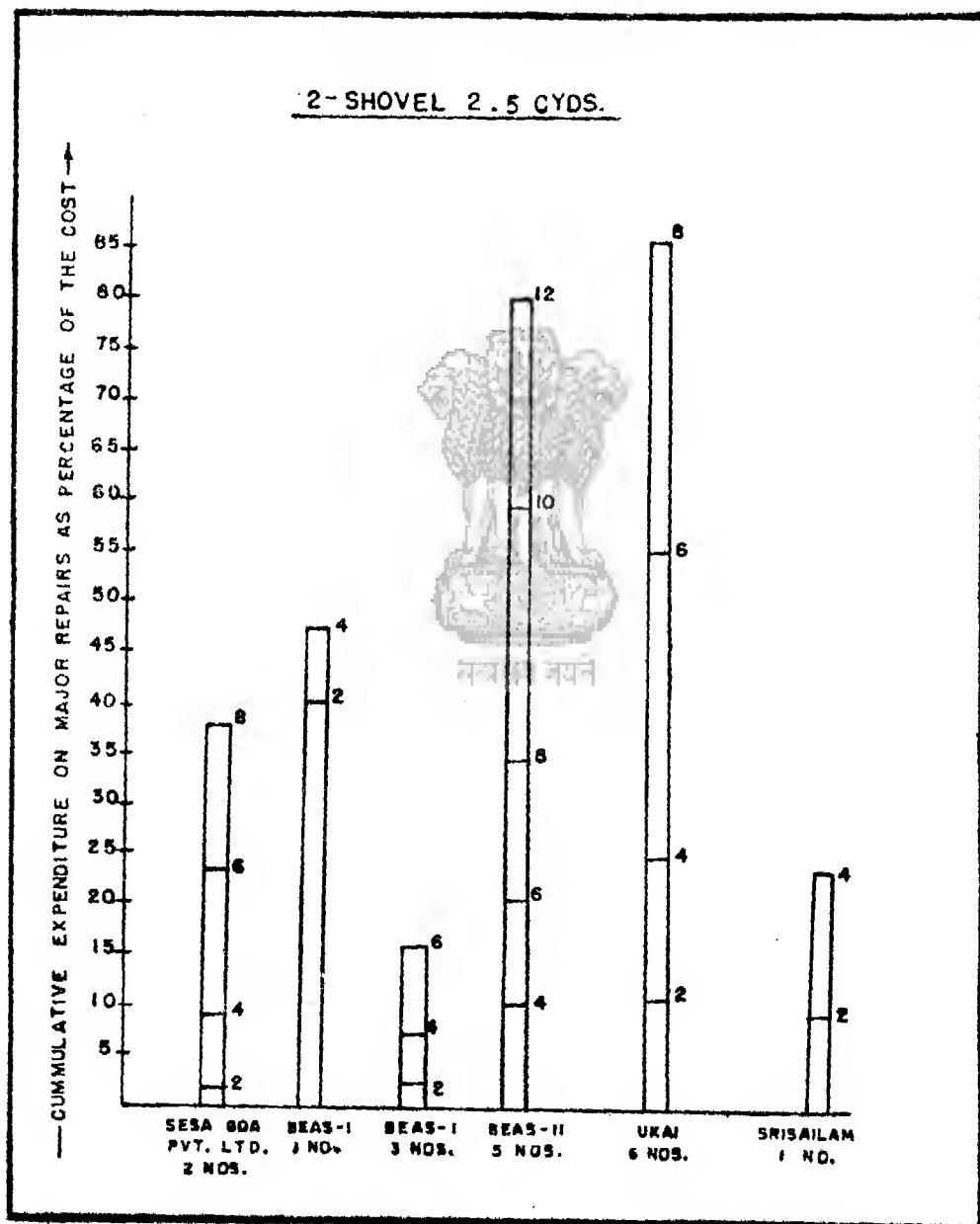
CUMMULATIVE EXPENDITURE ON MAJOR REPAIRS AS
PERCENTAGE OF THE COST AT DIFFERENT SLABS OF OPERA-
TIONAL HOURS

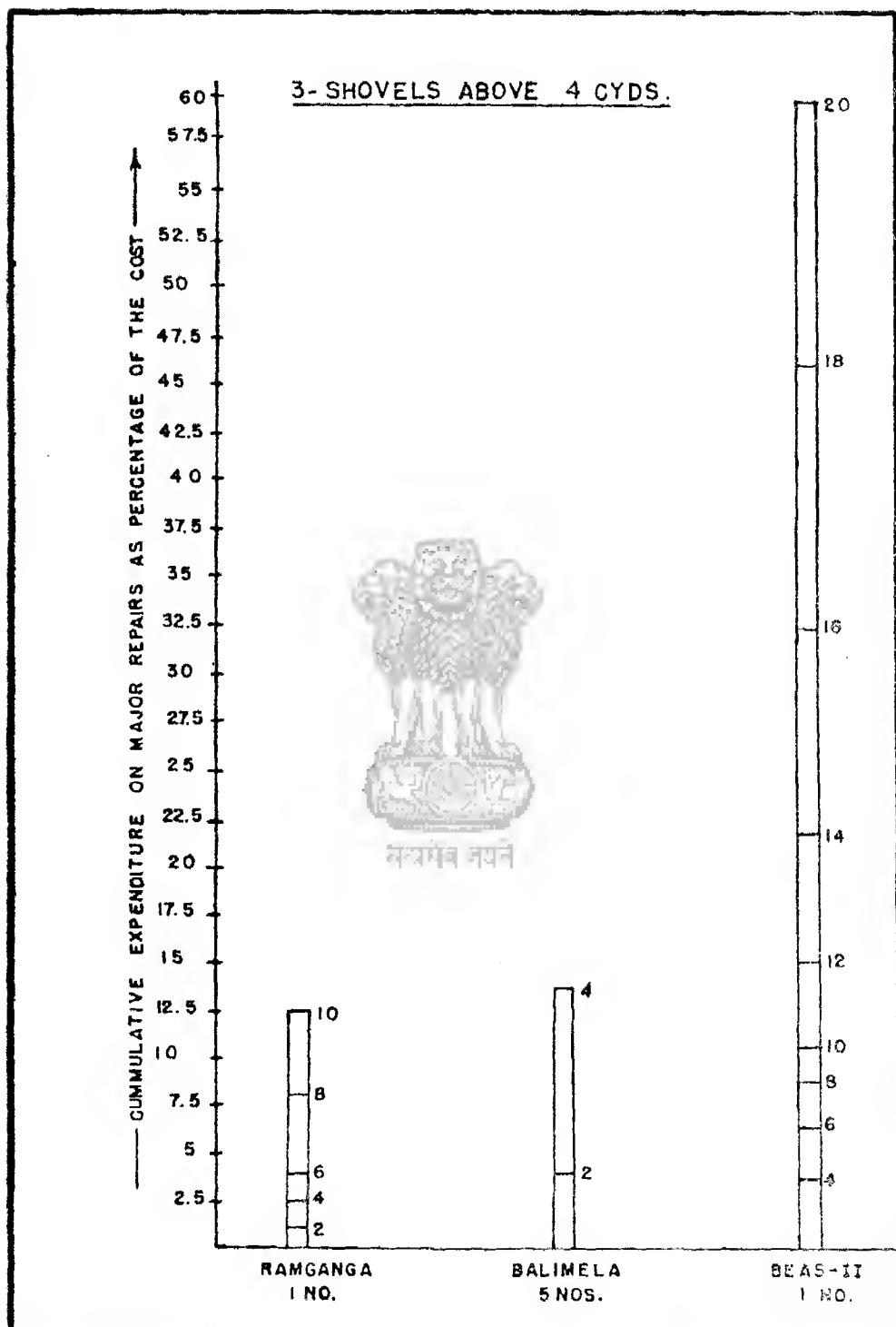
NOTE:- FIGURES ON THE BARS INDICATING SLABS
IN HOURS, ARE IN THOUSANDS.

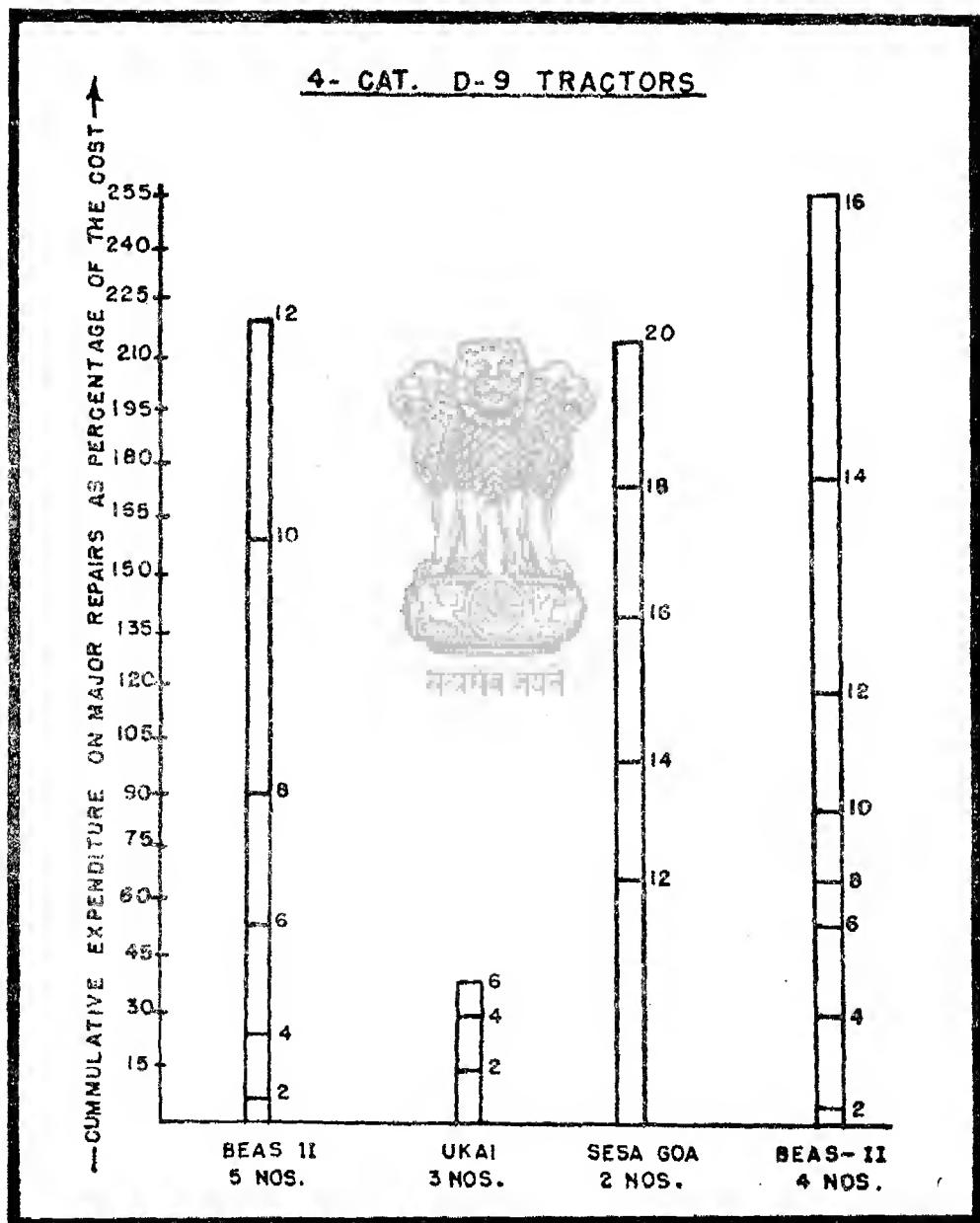
I- SHOVELS 1.5 CYDS.

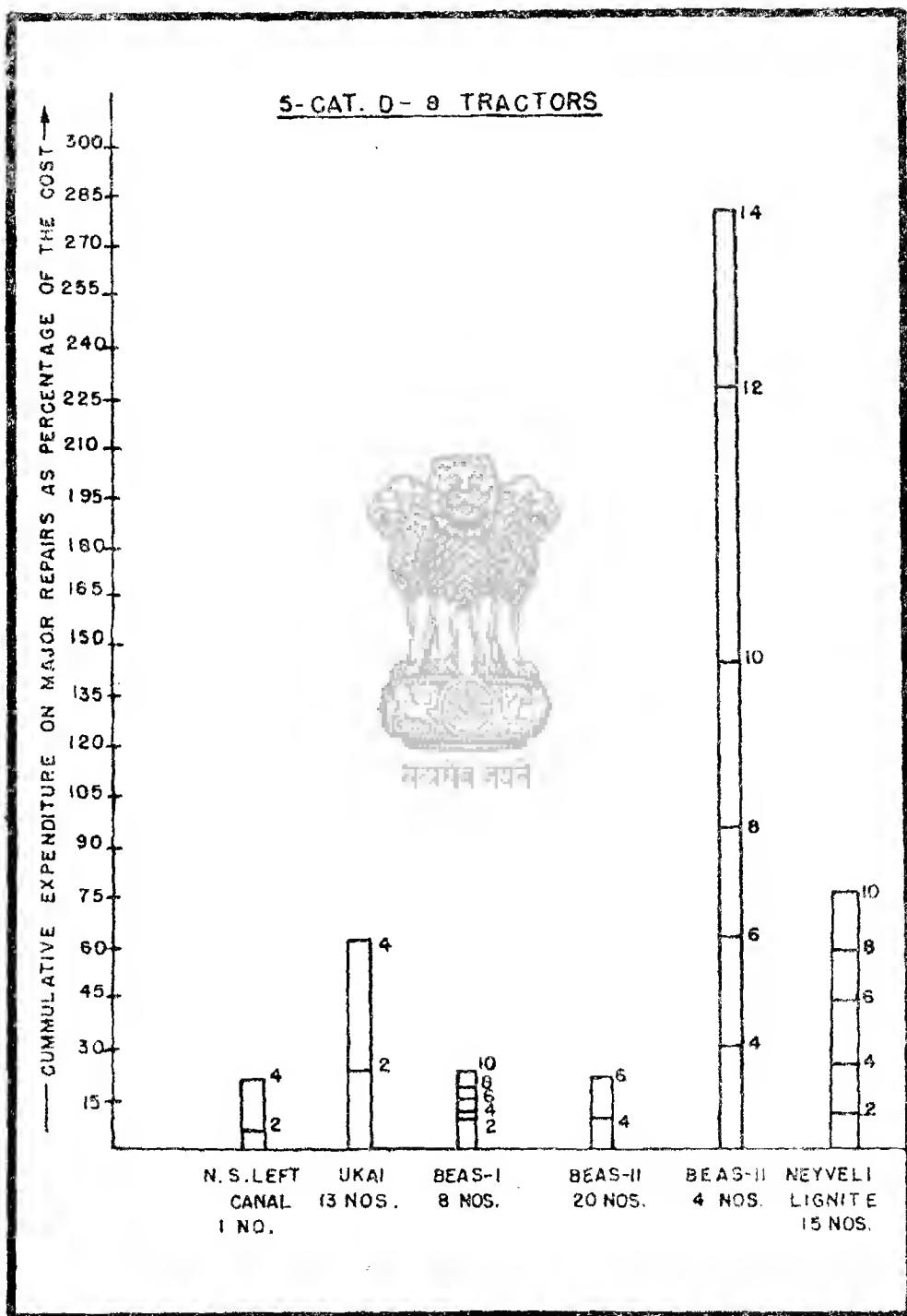


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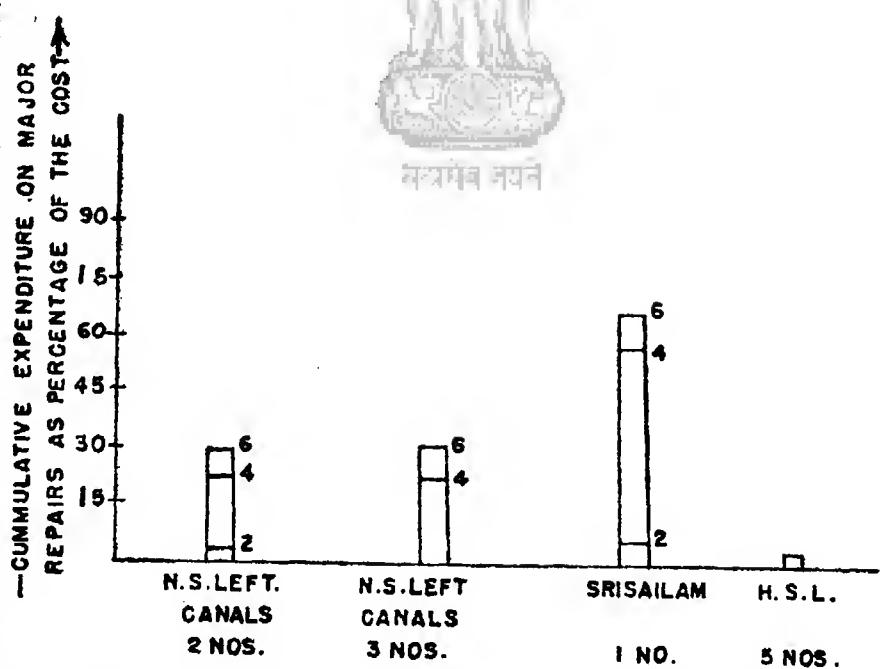




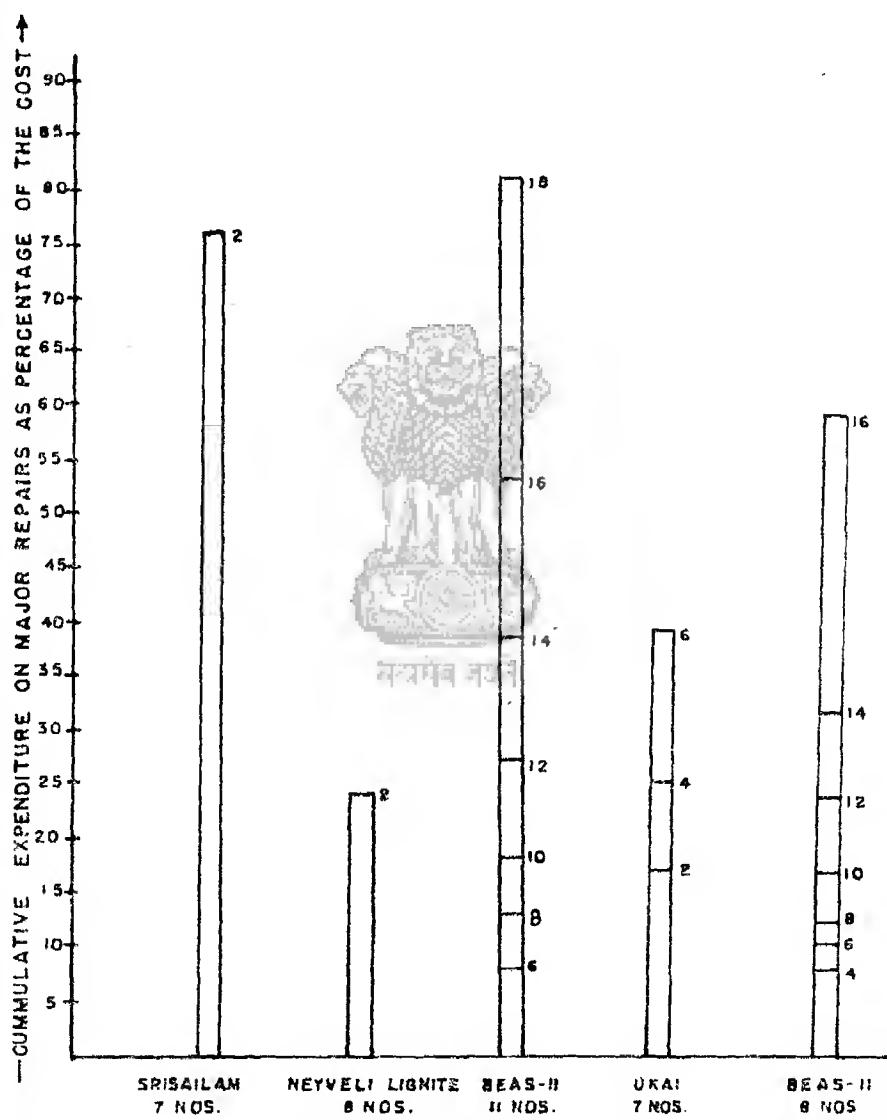


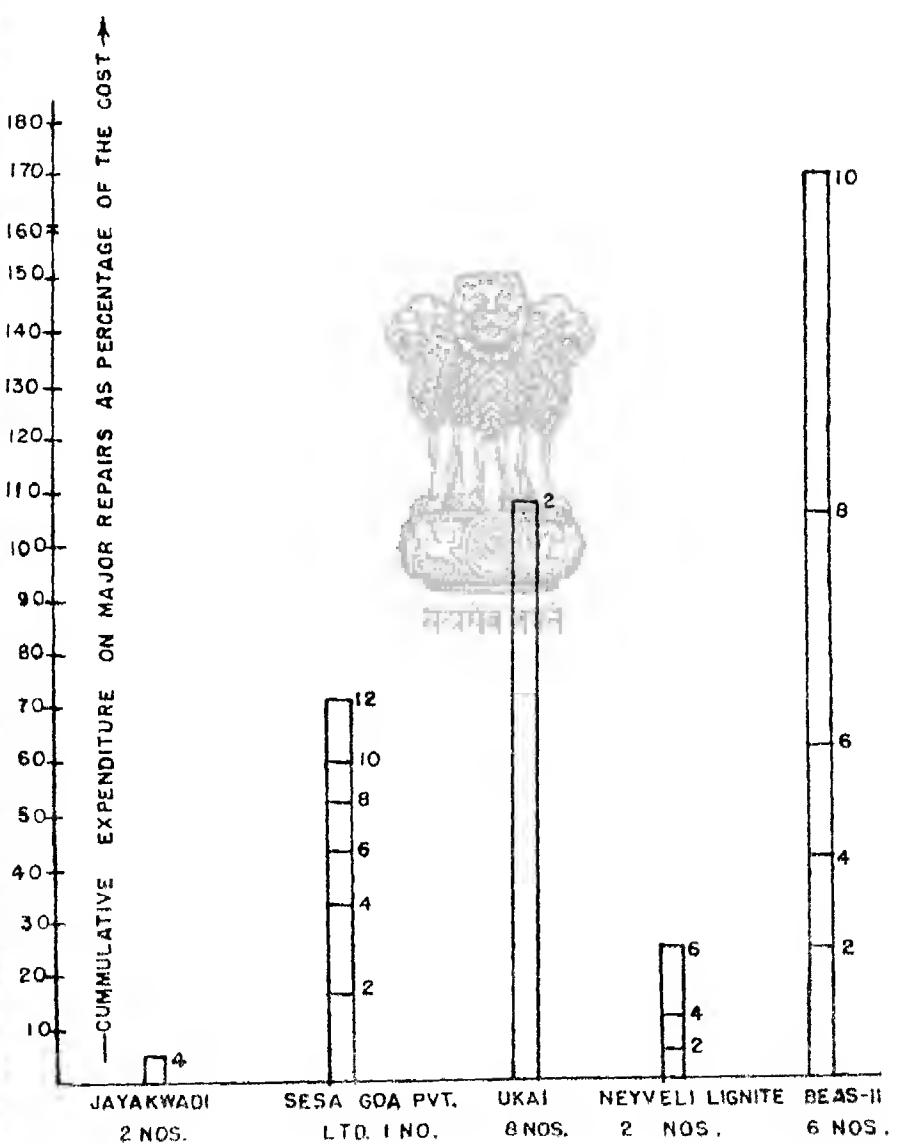


6- CAT. D-7 TRACTORS.

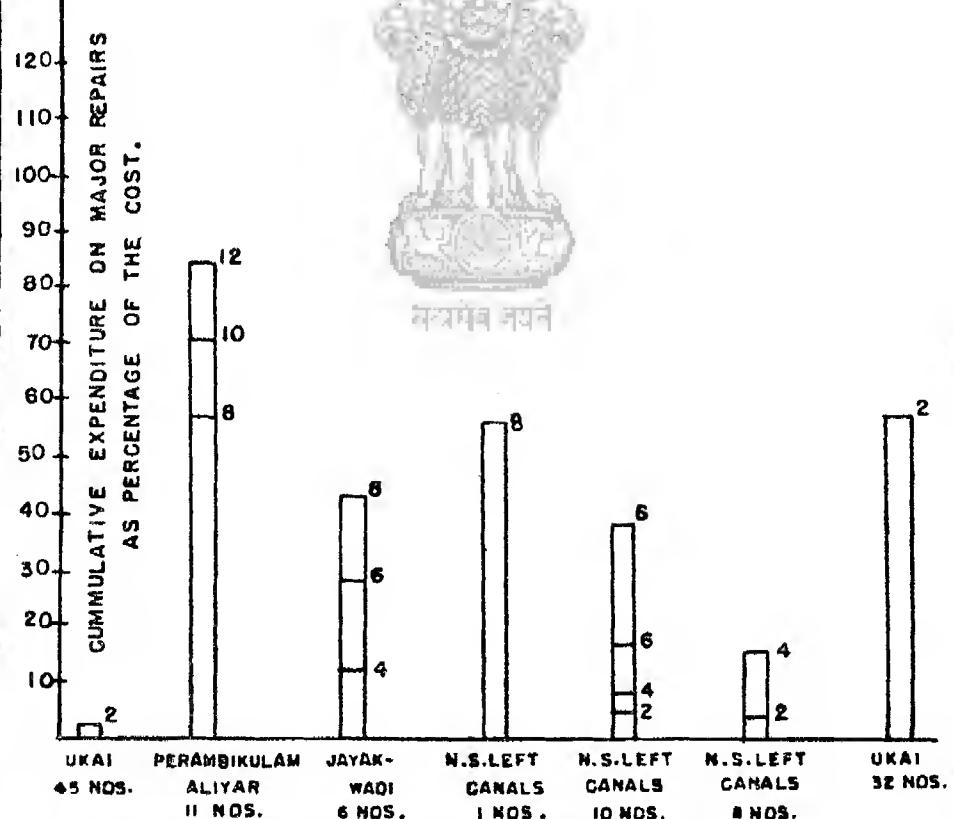


7 - DUMPERS. (BOTTOM)



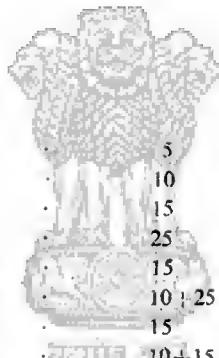
8 - MOTOR GRADERS

9- SCRAPERS (MOTORISED)



REPAIR PROVISION (MAJOR & FIELD COMBINED) (WITH AVERAGE OPERATING CONDITION)

Category of Equipment & Stage of life in hours	Repair provision as percentage of Cost of equipment	
	For the stage	Cumulative
1	2	3
1. Crawler Tractors		
2,000	5	5
4,000	20	25
6,000	35	60
8,000	20	80
10,000	30	110
12,000	10+40	120+40
14,000	25	185
16,000	15+15	200+15
18,000	20	235
20,000	15	250
Single Shift —12,000 hrs—120%		
Double Shift —16,000 hrs—200%		
Three Shifts —16,000 hrs—240%		
2. Motorised Scrapers		
2,000	5	5
4,000	10	15
6,000	15	30
8,000	25	55
10,000	15	70
12,000	10+25	80+25
14,000	15	120
16,000	10+15	130+15
18,000	20	165
20,000	15	180
Single Shift —12,000 hrs—80%		
Double Shift —16,000 hrs—130%		
Three Shifts —16,000 hrs—150%		
3. Elevating Scrapers (Motorised)		
2,000	5	5
4,000	20	25
6,000	35	60
8,000	20	80
10,000	30	110
12,000	10+40	120+40
14,000	25	185
16,000	15+15	200+15
18,000	20	235
20,000	15	250
Single Shift —12,000 hrs—120%		
Double Shift —16,000 hrs—200%		
Three Shifts —16,000 hrs—240%		



1	2	3
4. Towed Scrapers		
2,000	2.5	2.5
4,000	5.0	7.5
6,000	7.5	15.0
8,000	15.0	30.0
10,000	5.0	35.0
12,000	5.0+15	40+100
14,000	5	60
16,000	5+10	65+10
18,000	10	85
20,000	5	90
Single Shift	—12,000 hrs—40%	
Double Shift	—16,000 hrs—65%	
Three Shifts	—16,000 hrs—75%	
5. Dumpers, Rear		
2,000	2.5	2.5
4,000	7.5	10
6,000	15.0	25
8,000	20.0	45
10,000	15.0	60
12,000	10+25	70+25
14,000	15	110
16,000	10+15	120+15
18,000	15	150
20,000	10	160
Single Shift	—12,000 hrs—70%	
Double Shift	—16,000 hrs—120%	
Three Shifts	—16,000 hrs—140%	
6. Dumpers Bottom		
2,000	2.5	2.5
4,000	5.0	7.5
6,000	10.0	17.5
8,000	15.0	32.5
10,000	10.0	42.5
12,000	7.5+20	50+20
14,000	10.0	80
16,000	5+10	85+10
18,000	15	110
20,000	10	120
Single Shift	—12,000 hrs—50%	
Double Shift	—16,000 hrs—85%	
Three Shifts	—16,000 hrs—100%	

	1	2	3
7. Wheel Tractors			
2,000	.	2.5	2.5
4,000	.	5.0	7.5
6,000	.	10	17.5
8,000	.	15	32.5
10,000	.	10	42.5
12,000	.	7.5 + 20	50 + 20
14,000	.	10	80
16,000	.	5 + 10	85 + 10
18,000	.	15	110
20,000	.	10	120
Single Shift	--12,000 hrs—50%		
Double Shift	--16,000 hrs—85%		
Three Shifts	--16,000 hrs—100%		
8. Wheel Loaders			
2,000	.	2.5	2.5
4,000	.	5.0	7.5
6,000	.	10	17.5
8,000	.	15	32.5
10,000	.	10	42.5
12,000	.	7.5 + 20	50 + 20
14,000	.	10	80
16,000	.	5 + 10	85 + 10
18,000	.	15	110
20,000	.	10	120
Single Shift	--12,000 hrs—50%		
Double Shift	--16,000 hrs—85%		
Three Shifts	--16,000 hrs—100%		
9. Crawler Loaders			
2,000	.	5	5
4,000	.	20	25
6,000	.	35	60
8,000	.	20	80
10,000	.	30	110
12,000	.	10 + 40	120 + 40
14,000	.	25	185
16,000	.	15 + 15	200 + 15
18,000	.	20	235
20,000	.	15	250
Single Shift	--12,000 hrs—120%		
Double Shift	--16,000 hrs—200%		
Three Shifts	--16,000 hrs—240%		
10. Craders			
2,000	.	2.5	2.5
4,000	.	5	7.5
6,000	.	10	17.5
8,000	.	15	32.5
10,000	.	10	42.5
12,000	.	7.5 + 20	50 + 20

	1	2	3
14,000	.	10	80
16,000	.	5+10	85+10
18,000	.	15	110
20,000	.	10	120
Single Shift	—12,000 hrs— 50%		
Double Shift	—16,000 hrs— 85%		
Three Shifts	—16,000 hrs—100%		
11.	<i>Excavators upto 2½ cu. yds. (Diesel)</i>		
2,000	.	2·5	2·5
4,000	.	7·5	10
6,000	.	10	20
8,000	.	15	35
10,000	.	10	45
12,000	.	5+15	50+15
14,000	.	10	75
16,000	.	5+10	80+10
18,000	.	10	100
20,000	.	10	110
Single Shift	—12,000 hrs— 50%		
Double Shift	—16,000 hrs— 80%		
Three Shifts	—16,000 hrs— 90%		
12.	<i>Excavators above 2½ cu. yds. to 4 cu. yds. (Diesel)</i>		
2,000	.	2·5	2·5
4,000	.	2·5	5
6,000	.	5·0	10
8,000	.	7·5	17·5
10,000	.	7·5	25
12,000	.	10·0	35
14,000	.	10·0	45
16,000	.	5+10	50+10
18,000	.	10	70
20,000	.	5+10	75+10
22,000	.	10	95
24,000	.	5	100
Single Shift	—16,000 hrs— 50%		
Double Shift	—20,000 hrs— 75%		
Three Shifts	—20,000 hrs— 80%		
13.	<i>Excavators above 4 cu. yds. (Diesel or Diesel Electric)</i>		
2,000	.	—	—
4,000	.	2·5	2·5
6,000	.	2·5	5·0
8,000	.	2·5	7·5
10,000	.	5·0	12·5
12,000	.	5·0	17·5
14,000	.	7·5	25·0
16,000	.	10·0	35·0
18,000	.	10·0	45·0
20,000	.	5+10	50+10
22,000	.	10	70

	1	2	3
24,000	.	5.5	75.5
26,000	.	10	90
28,000	.	5	95
30,000	.	5	100
Single Shift	—20,000 hrs—50%		
Double Shift	—24,000 hrs—75%		
Three Shifts	—24,000 hrs—80%		
14. Excavators above 4 cu. yds. (Electric)			
3,000	1.0	1.0	
6,000	1.5	2.5	
9,000	5.0	5.0	
12,000	7.5	12.5	
15,000	10.0	22.5	
18,000	10.0	32.5	
21,000	7.5	40.0	
24,000	15.0	55.0	
27,000	10.0	65.0	
30,000	5.5	70.5	
33,000	10.	85	
36,000	7.5	92.5	
40,000	7.5	100	
Single Shift	—30,000 hrs—70%		
Double Shift	—40,000 hrs—100%		
Three Shifts	—40,000 hrs—100%		
15. Compactors			
2,000	2.5	2.5	
4,000	5.0	7.5	
6,000	10.0	17.5	
8,000	15.0	32.5	
10,000	10.0	42.5	
12,000	7.5 + 20	50 + 20	
14,000	10	80	
16,000	5 + 10	85 + 10	
18,000	15	110	
20,000	10	120	
Single Shift	—12,000 hrs—50%		
Double Shift	—16,000 hrs—85%		
Three Shifts	—16,000 hrs—100%		

NOTE:— 1. Repair Provision includes cost of Labour and Spares.

2. Escalation in Price of spare parts and the Inventory carrying cost (which includes the cost of obsolescence) have not been accounted for.
3. Figures after + (plus) signs indicate the value of component replacement at the stages.
4. The figures of provision indicate the likely expenditure on repairs at different stages. This does not indicate the stocking pattern of spare parts.

MULTIPLYING FACTOR TO THE PURCHASE COST FOR ESTIMATING REPAIR PROVISION DURING THE LIFE TIME OF EQUIPMENT AT DIFFERENT OPERATING CONDITIONS

Sl. No.	Category of Equipment	Single Shift Operating Condition			Double Shift Operating Condition			Three Shifts Operating Condition		
		E	A	S	E	A	S	E	A	S
1. Crawler Tractor	· · · · ·	0·9	1·2	1·7	1·6	2·0	3·0	2·0	2·4	3·6
2. Drawn Scraper	· · · · ·	0·3	0·4	0·6	0·50	0·65	1·0	0·6	0·75	1·1
3. Wheel Scraper	· · · · ·	0·6	0·8	1·2	0·9	1·3	1·8	1·2	1·5	2·3
4. Bottom Dumper	· · · · ·	0·4	0·5	0·7	0·6	0·85	1·2	0·95	1·0	1·4
5. Rear Dumper	· · · · ·	0·5	0·7	1·0	0·8	1·2	1·6	1·0	1·4	2·0
6. Wheel Tractor	· · · · ·	0·35	0·5	0·75	0·6	0·85	1·3	0·75	1·0	1·6
7. Track Loader	· · · · ·	0·9	1·2	1·7	1·6	2·0	3·0	2·0	2·4	3·6
8. Wheel Loader	· · · · ·	0·35	0·5	0·75	0·6	0·85	1·3	0·75	1·0	1·6
9. Grader	· · · · ·	0·3	0·5	0·70	0·50	0·85	1·1	0·6	1·0	1·3
10. Compactor	· · · · ·	0·35	0·5	0·75	0·6	0·85	1·3	0·75	1·0	1·6
11. Excavator:										
(i) Electric, 4 cu. yds. and above	·	0·4	0·7	0·8	0·6	1·0	1·2	0·6	1·0	1·2
(ii) Electric 2·5 to 4 cu. yds.	·	0·3	0·5	0·7	0·5	0·75	1·0	0·5	0·8	1·1
(iii) Diesel 4 cu. yds. and above	·	0·3	0·5	0·7	0·5	0·75	1·0	0·5	0·8	1·1
(iv) Diesel 2·5 to 4 cu. yds.	·	0·4	0·5	0·75	0·6	0·75	1·1	0·6	0·8	1·2
(v) Diesel upto 2·5 cu. yds.	·	0·4	0·5	0·75	0·6	0·80	1·2	0·7	0·9	1·3

NOTE.—'E' = Excellent, 'A' = Average and 'S' = Severe.

CLASSIFICATION OF JOB CONDITIONS AS LIGHT, MEDIUM & SEVERE

Equipment	Significance of job conditions			
	Light		Medium	Severe
	1	2	3	4
Crawler Tractors	· · · · ·	Pulling scrapers, most agricultural drawbar, stockpile, coalpile and landfill work. No impact. Intermittent full throttle operation.	Production dozing in clays, sands, gravels. Push-loading scrapers, borrow pit ripping most land-clearing and skidding applications. Medium impact conditions.	Heavy rock ripping. Tandem ripping. Push-loading and dozing in hard rock. Work on rock surfaces. Continuous high impact conditions.
Wheel Scrapers	· · · · ·	Level or favourable hauls on good haul roads. No impact. Easy loading materials.	Varying loading and haul road conditions. Long and short hauls. Adverse and favourable. Some impact. Typical road-building use on a variety of jobs.	High impact condition, such as loading ripped rock. Over loading. Continuous high total resistance conditions. Rough haul roads.
Off Highway Dumpers (Rear and Bottom)	· · · · ·	Mine and quarry use with properly matched loading equipment. Well maintained haul roads. Also construction use under above conditions.	Varying loading and haul road conditions. Typical road-building use on a variety of jobs.	Consistently poor haul road conditions. Extreme overloading. Oversized loading equipment.

	1	2	3	4
Track Loaders		Intermittent truck loading from stockpile. Minimum travelling, turning. Free flowing, low density materials with standard bucket. No impact.	Bank excavation, intermittent ripping, basement digging of natural bed clays, sands, silts, gravels. Some travelling. Steady full throttle operation.	Loading shot rock, cobbles, glacial till, caliche. Steel mill work. High density materials in standard bucket. Continuous work on rock surfaces. Large amount of ripping of tight, rocky materials. High impact conditions.
Wheel Tractors		Light utility work. Stockpile work. Pulling compactors. Dozing loose fill. No impact.	Production dozing, push-loading in clays, sands, silts, loose gravels. Shovel clean-up. Compactor use.	Production dozing in rock. Push-loading in rocky, bouldery borrow pits. High impact conditions.
Wheel Loaders		Intermittent truck loading from stockpile, hopper charging on firm, smooth surfaces. Free flowing, low density materials. Utility work in governmental and industrial applications. Light snowplowing.	Continuous truck loading from stockpile. Low to medium density materials in properly sized bucket. Hopper charging in low to medium rolling resistance. Hoading from bank in good digging.	Loading shot rock (large loaders). Handing high density materials with counter-weighted machine. Steady loading from very tight banks. Continuous work on rough or very soft surfaces.
Grader		Light road maintenance. Finishing. Plant and road mix work. Light snowplowing. Large amounts of travelling.	Haul road maintenance. Road construction, ditching. Loose fill spreading. Land-forming, landlevelling. Summer road maintenance with medium to heavy winter snow removal. Elevating grader use.	Maintenance of hard packed roads with embedded rock. Heavy fill spreading. Ripping-scariifying of asphalt or concrete. Continuous high load factor. High impact.
Compactors (Wheel Type)		Light utility work. Stockpile work. Pulling compactors. Dozing loose fill. No impact.	Production dozing, push-loading in clays, sands, silts, loose gravels. Shovel clean up. Compactor use.	Production dozing in rock. Push-loading in rocky, bouldery borrow pits. High impact conditions.
Excavators		Loose, soft, free running materials. Close lying, which will fill dipper or bucket full.	Materials requiring some breaking up by light blasting or shaking. More bulky and somewhat hard to penetrate, causing voids in dipper or bucket. Harder materials that are not difficult to dig without blasting but break up with bulkiness, causing voids in the dipper or bucket.	Blasted rock, hardpan, and other bulky materials, which cause considerable voids in dipper or bucket and difficult to penetrate or load.

ESTIMATED MAN HOURS REQUIRED FOR COMPLETE OVERHAULS OF EQUIPMENT AND COMPONENTS

	Larsen Toubro	Tractors India Ltd.	Beas	N.M.D.C.	Neyveli
(a) Caterpillar Diesel Engines with starting Engines.					
D-7	325	333.8	160	288	350
D-8	385	338.5	D-8, H-200 D-8 -160	288	350
D-9	430	435.5	200	288	350
(b) Caterpillar Tractors with attachment.					
D-7	1055	1198	600	2500	1200
D-8	1365	1514	D-8, H-800 D-8 - 600	2500	1200
D-9	1560	1821	800	3000	1200
(c) Caterpillar Track Assembly and Components.					
	Larsen Toubro	Beas	N.M.D.C.		Neyveli
	D-9	D-8	D-7	D-9	D-8
Link	60	42	4-30	4-30	32
Rollers	68	50	40	15	64
Idlers	68	50	40	15	16
Sprockets	68	50	40	12	32
Grousers	60	50	42	48	64
Carrier Rollers	58	50	40	12	96
Bushing	60	50	42	12	12
(d) To Re-assemble Caterpillar Track Assembly and Components.					
Links			15	15	32
Rollers				48	24
Idlers				48	32
Sprockets				48	64
Grousers				48	96
Carrier Rollers				12	12
Bushing				12	12

APPENDIX 8.11

AVERAGE MAN HOURS REQUIRED FOR REBUILDING OF WORN OUT TRACK COMPONENTS

	Larsen Toubro			Tractors India			Ranganga			Beas			Rajasthan Canal			Neyveli		
	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-8	D-7	D-9	D-8	D-7	
Link	.	.	.	60	40	36	29	23	18	.	.	.	104	78	62	48	40	..
Roller Set	.	.	.	42	33.5	22.5	32	26	19	75	42	..	28	20	15	48	32	96
Idlers	.	.	.	17	13	9	11	10	6	51	45	..	8	8	6	32	24	40
Sprockets	.	.	.	14	12	10	20	16	12	90	72	..	..	..	..	96	64	40
Grousers	.	.	.	66.5	60	52	78	66	49	468	392	..	..	..	..	..	..	32
Carrier Rollers	8	6	6	9	4.5	..	6	4	3	..	..	..

REQUIREMENTS OF WELDING MATERIAL AND FLUX FOR REBUILDING IN KG.

	Larsen Toubro			Tractors India			Beas			Ranganga			Neyveli			Rajasthan Canal Project		
	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7
Link	W	102	48	40	90	75	50	140	105	83	..	..	..	..	..	..	..	..
Grousers	W	192	133	112	48	42	33	1400	1310	1200	2580	2050	..	8.5	8.5	8.5	..	..
Carrier Rollers	F	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rollers	W	59	45	33	..	..	..	35	27	21	80	40	..	8.1	8.1	8.1	..	40
														each	each	each	each	..

Sprockets	F	94	66	45	..	..	..	35	27	21	60	30	..	8.1	8.1	8.1	..	15	10
	W	5	4	3	720	660	540	1150	575	..	10	10	10	..	150	110
									Number	ft.				..	10	10	10	..	Nos. Rods.	

Idlers	F	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	W	40	30	24	35	25	18	27	27	20	50	45	..	10.8	10.8	10.8	..	30	20

	Ele. Rods. 4MM 5MM																	

W—stands for Welding Rods.
F—stands for Welding Flux.

MAX WEAR LIMITS OF TRACK COMPONENTS IN MILLIMETER

	Larsen Toubro			Tractors India			Beas			N.M.D.C.			Rajasthan Canal			
	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-9	D-8	D-7	D-9
Link	10	10	10	10	10	10	10	10	10	15	15	15	15	15	15	9
Rollers (dia)	18.7	21.3	10.1	10	10	20	20	20	20	6	6	6	6	6	6	19
Idlers (dia)	19.0	19.0	20.0	10	10	10	10	10	10	6	6	6	6	6	6	9
Sprockets	on knife edge.	10	10	10	10	10	10	10	10	15	15	15	15	15	15	9.25
Grousers bar height	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	8
																6
																45
																39

ESTIMATE AVERAGE WORKING HOURS FOR WHICH REBUILT TRACK COMPONENTS LAST IN SERVICE

- (1) Larsen Toubro :— 70% of the working hour obtained from new components.
- (2) Tractor India :— 70% to 80% of the working hour obtained from new components.
- (3) Beas :— 1000—2000 hours.
- (4) N.M.D.C. :— 1500—2000 hours.
- (5) Rajasthan Canal :— 1500—2000 hours.
- (6) Neyveli :— 3500—4000 hours.

TYRE LIFE

Name of Project	Machine on which tyre is used	New life in hours	Retreaded life in hours
N.M.D.C.	Rear Dumpers	1400	900
Kiriburu	Haul-Pack	900	500
N.C.D.C.	Dumpers	1800—2000	1800
Ramganga	Scrapers Rear Dumpers Bottom Dumper Loader Grader Dozer	2000 3000 1500—2000 1500 2000 1800	
Beas	33·5 x 33—32PR 37·5 x 33—36 37·5 x 33—42 33·5 x 39—38	2500—3000 2500—3000 1500—2000 2500—3000	
Ukai	WABCO Dumpers & Scrapers	2000	
H.S.L. Rourkela			
Barsua Mines	Dumpers	1800—2000	
Rajhara Mines	Dumpers Belaz	15000—20000 KM	10,000 KM
TISCO			
Noamandi Mines	Mack Dumpers	3000—4000 hours	3000 hours
Neyveli	Cat. Dumpers Haul-pak	5000 hours 4000 hours	
R.C.P.	Towed Scrapers	8000 hours	

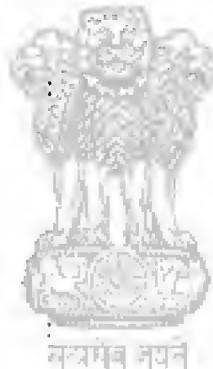
SUMMARY OF INFORMATION RECEIVED FROM VARIOUS DEPARTMENTS/PROJECTS ON THE RATE STRUCTURE OF HIRE CHARGES OF EARTH MOVING AND CONSTRUCTION EQUIPMENT

Name of the State/ Project	Rate of Depre- ciation	Interest Charges	Major and Field repair charges	Operation & Supervision charges	Departmental Charges	Remarks
1	2	3	4	5	6	7
<i>I. Andhra Pradesh</i>						
Chief Engineer, N.S. Dam.	C per hour N	5% per annum on capital cost (leviable from contractors only)	100% of depreciation	Certain fixed charges	Not indicated	For machinery hired on daily basis, 8 working hours will be reckoned as a day. The Calendar day is from 12 midnight to 12 midnight. For levy of charges, 4 hours or less will be reckoned as half a day and more than 4 hours as half a day. In case of breakdown of machines, the actual hours of working may be charged at the discretion of Exe- cutive Engineer. In a calendar day any extra charges over and above those included in the hire charges, incurred for crew for in- termittant work should be re- covered from the Contractor. The minimum charges during the month shall not be less than the charges for 20 days.
2. Badarpur Thermal Power Station	C per hour N	6% on the Capi- tal Cost per annum	100% of depreci- ation in the case of tractors & 60% of depreciation in the case of Crawler & tyred Cranes.	As per actuals plus 25% of Labour charges for Columns 2 to 5.	12½% of the total of 6 hours of working in 8 hours	Daily rate as charged by assuming 6 hours of working in 8 hours
3. Gujarat State	C per hour N	6% on Capital cost	Major repairs 120% of depreciation. Maintenance and Field repairs 25% of Major repairs.	P.O.L. & Crew charges as per actuals. Super- vision charges 10% of depreciation and Major repairs.	10% of depreciation	1. While calculating the interest charges schedule working hours are to be taken as 2500 & 1250 on two shifts & one shift basis respectively. 2. <i>Principles for calculating the rates for Idle hours—</i> (i) Dep. $\frac{1}{4}$ of the normal depreciation. (ii) Wages of operating crew.



1	2	3	4	5	6	7
4.	Jammu & Kashmir Chief Engineer, Mec- hanical and Stores Dept. Jammu,	C per hour	Not indicated	100% of depreciation Overhead:— As per usual practice in the project.	Operational charges:— (a) Wages at actuals. (b) Fuel as recommended by the manufacturers or as calculated on the basis of Horse Power. (c) Lubricants etc. at 25% of the cost of fuel Overhead:— As per usual practice in the project.	(iii) Overtime:—10% of Nor- mal depreciation. (iv) Interest:—As in case of working hours rate. 3. In case the equipment is idle on account of the contractor for full or part time of the shift the hire charges will be as per 2 above plus 10% extra.
5.	Kerala State State Electricity Board and Chief Engineer Irrigation	C per annum	5% per annum	4% per annum	10% per annum	<i>Class A Equipment</i>
	Class A Equipment.					
	Class B Equipment]	8½% per annum	4% per annum	4% per annum	10% per annum	<i>Class B Equipment</i>
	Class C Equipment	16½% per annum	4% per annum (The percentage will be based on the original cost or the appraised value where the cost is not known).	4% per annum (The percentage will be based on the original cost or the appraised value where the cost is not known).	P.O.L. and Crew charges as per actuals.	<i>Class C Equipment</i>
	J. Maharashtra	C per hour	6% of Capital cost per annum	120 to 150% of de- preciation.	10% of Cols. 2, 4 & 5.	The charges are for Class I, item of equipment which comprise of heavy earthmoving machinery:— For other class of equipment (without prime mover as an integral part) 3-2% of capital cost per month on single shift working which include depreciation, tyre replacement and supervision charges.

1	2	3	4	5	6	7
7. <i>Mysore</i>	Superintending Engineer Central Mechanical Organisation, Dharwar.	₹ per hour	5% per annum on capital cost.	Major Repairs different machines. Field Repair 30% to 50% of Capital cost.	Cost of fuel, lubricants, grease, cotton waste etc. as per issue rate or market rate whichever is higher. Operating Crew: Wages as per actuals plus 50% of wages towards leave, idle period and retrenchment and other benefits.	Assumption made on working of equipment: at 8 hours/shift, 25 days/month and 10 months/year.
8. <i>Orissa State</i>	Mechanical Circle, Hirakud.	₹ per hour	100% of depreciation cost.	Not levied	P.O.L. and Crew charges are to be paid by the party hiring equipment as per actuals.	(i) No separate provision is made for Field Repairs. (ii) For idle period, $\frac{1}{2}$ of hire charges are levied.
9. <i>Punjab State</i>	Punjab Departmental Financial Rules.	..	..	..	..	(i) Rule 2-21:—



NOTE:—When any plant or machinery belonging to an Irrigation Branch Division is lent for use in another Irrigation Branch Division, working under a different unit, a hire charge of 16% per annum on the original purchase price of the plant should be charged. The period for which the hire charge is to be levied in such cases should be that for which the plant is actually in use in borrowing Division. No hire charges should be levied for the period the plant remains idle in the borrowing Division.

(ii) Rules 4-16:—

Note:—When tools and plant belonging to the Irrigation Branch are lent outside the Department, a hire charge of 5% per mensem on the original purchase price of the plant should be levied for the entire period the plant is away from the Irrigation Branch Division concerned.

1	2	3	4	5	6	7
In addition to the above hire charges the borrowing department must pay carriage on the plant both ways and be responsible for the cost of running repairs as distinct from special overhaul. The cost of special overhaul should be borne by the Irrigation Branch Division to which the Plant or Machinery belongs.						
10. <i>Rajasthan State</i>	Rajasthan Canal Project, Suratgarh.	C per hour N	6% per annum on Capital cost.	Different for different machines.	As per actuals (10% of operational charges as supervision charges extra for contractors).	Departmental charges 14.5% T&P charges. 1.5% Audit and Account charges. 1.0% Pensionary charges. 0.94% 17.94% of the total hire charges.
						The rate of hire charges shall be fixed on the basis of hourly rate worked out taking into account both Direct & Indirect charges viz. wages of operators, helpers, depreciation charges, Supervision charges & major overhaul fund, repairs & renewals on account of fair, wear & tear & interest on capital cost etc. The machines shall be lent out on hire for a period not exceeding 3 months.
11. <i>Tamilnadu State</i>	(i) Chief Engineer Irrigation, Chennapakkam.	C per hour N	6% per annum on Capital cost.	Major repairs 75% of depreciation. Field repairs 25% of depreciation.	Fuel and Lubricants at actuals. Cost of labour at actuals plus 25% of the labour cost to cover incidentals like-wages paid during non working season etc.	(i) The cost of labour to carry out the repairs and General charges levied by the Workshop is covered by the percentage provided for repairs. No separate Supervision charges are accounted for. (ii) P.O.L. & Crew charges as per actuals.
	(ii) Parambikulam Aliyar Project	0.95C — N		It is subject to levy of interest of depreciation and till the cost is repair; interest of depreciation not worked out.		

	1	2	3	4	5	6	7
12. Uttar Pradesh							
(a) Superintendent Engineer, Central Equipment and Store, Lucknow (Obra Dam)	C per hour	Not included.	Major repairs at 100% of depreciation & minor re- pairs at 49% of de- preciation.	As per fuel consumption formulae. Labour char- ges as per actuals plus 50% extra for non-work- ing season.			
(b) Tons civil Con- struction Circle (UP)	0.9C per hour.	Not included.	Major repairs at 70% to 100% of cost of equipment & repairs and maintenance 40% of cost of equipment.	(i) 10% of operational charges supervision charges given on hire to contractor. (ii) P.O.L. as per fuel consumption formula. Crew charges as per actuals.	5% extra of the total towards idle charges.		
(c) Gandak Canal Construction Circle (UP)	1.1C N per hour	Not included	Major repairs at 72 % Minor repair at 30% of depreciation.	P.O.L. and labour charg- es as per actuals.	Departmental charges 10% of Major repairs		
(d) Rameang Project (UP)	0.9C N per hour	6½% of the average annual investment.	Major repairs at 100% Minor repairs at 40% of depreci- ation. Sundries—5% minor repairs.	P.O.L. & labour charges as per actuals. Over- head charges @10% of total hire charges.			
13. West Bengal							
Chief Engineer, Far- kka Barrage.	0.9C N per hour	6% on the aver- age Annual in- vestment per annum.	130% of depre- ciation.	As per actuals.	2% of depreciation.		
H.S.I. Bhilai.	C N per hour	10% on average Annual invest- ment.	50% of depreciation for Stationery equi- ipment. 80% of de- preciation for Whe- eled equipment. 100% of depre- ciation for Crawler eq- ipment.	As per actuals.	17½% of the totals of col- umns 2 to 6.		

NOTE:- C= Capital Cost of the Machine.
N= Schedule life in hours.

APPENDIX 9.2

STATEMENT SHOWING THE LIFE OF EQUIPMENT AND THE ESTIMATED OWNERSHIP COST

Equipment	Life in Yrs.	Annual Ownership Cost as a % of cost of Eqpt.				Hours used per year	Hourly ownership cost on yearly basis as a factor of Eqpt. cost.
		Deprec- ation	Repair Cost	Interest at 6%	Total		
1	2	3	4	5	6	7	8
1. EXCAVATORS							
(i) Upto 2½ Cyds. Diesel . . .	5	20	12	3.6	35.6	2,000	0.0178
		10,000					
(ii) 2½ to 4 Cyds. Diesel . . .	8	12.5	9	3.4	24.9	2,000	0.01245
		16,000					
(iii) 2½ to 4 Cyds. Elect. . .	10	10	8	3.3	21.3	2,000	0.01065
		20,000					
(iv) Above 4 Cyds. Elect. . .	12	8	6	3.2	17.2	2,000	0.0086
		24,000					
2. DUMPERS . . .							
	5	20	16	3.6	39.6	2,000	0.0198
	10,000						
3. SCRAPERS							
Motorised	5	20	20	3.6	43.6	2,000	0.0218
	10,000						
4. TRACTORS							
A. Below 50H.P.							
(i) Crawler	4	25	25	3.75	53.75	2,000	0.02688
	8,000						
(ii) Wheeled	4	25	10	3.75	38.75	2,000	0.01938
	8,000						
B. Above 50 H.P.							
(i) Crawler	5	20	30	3.6	53.6	2,000	0.0268
	10,000						
(ii) Wheeled	5	20	12	3.6	35.6	2,000	0.0178
	10,000						
5. GRADERS							
	5	20	12	3.6	35.6	2,000	0.0178
	10,000						

1	2	3	4	5	6	7	8
6. LOADERS							
(i) Wheeled	5	20	12	3.6	35.6	2,000	0.0178
	<u>10,000</u>						
(ii) Cralwer	5	20	30	3.6	53.6	2,000	0.0268
	<u>10,000</u>						
7. CRANES							
(i) Crawlers upto 15T at 10' rad.	5	20	10	3.6	33.6	16,000	0.021
	<u>8,000</u>						
Upto 40T at 15' rad.	8	12.5	7.5	3.4	23.4	1,200	0.018
	<u>10,000</u>						
(ii) Truck Mounted	5	20	10	3.6	33.6	1,600	0.021
	<u>8,000</u>						
8. ROLLERS							
(i) Shceepfoot (towed)	4	25	5	3.75	33.75	1,500	0.0225
	<u>6,000</u>						
(ii) High Speed Compactors	5	20	12	3.6	35.6	2,000	0.0178
	<u>10,000</u>						
(iii) Smooth drum	7	15	10	3.5	28.5	2,000	0.0143
	<u>14,000</u>						
9. COMPRESSORS							
(i) Portable upto 300 cfm.	4	25	10	3.75	38.75	1,200	0.0323
	<u>5,000</u>						
(ii) Above 300 cfm.	5	20	8	3.6	31.6	1,200	0.025
	<u>6,000</u>						
10. DRILLS							
(i) Jack-hammers	3	33	5	4	42	1,200	0.035
	<u>3,600</u>						
(ii) Wagon drills	7	15	10	3.5	28.5	1,400	0.0204
	<u>10,000</u>						
11. CONCRETE MIXERS							
.	4	25	10	3.75	38.75	1,500	0.0255
	<u>6,000</u>						

NOTE.— 1. Repair cost as indicated is for average conditions.

2. Repair cost includes escalation and obsolescence of factor of spare parts required for the repairs.

3. Replacement of tyres is not included in the repair cost of Pneumatic tyred equipment. If the operation charges are to be borne by the contractor and this is required to be charged then the repair charges of Pneumatic tyred equipment may be increased by 10 to 15% of the cost, by calculating the element of tyre cost from the equation given at para 9.6.5.2 of this chapter.

APPENDIX 9.3.1.**DAILY REPORT OF THE OPERATION OF EQUIPMENT GIVEN ON HIRE**

Equipment Code No. Date

Name of Lessee Shift

Where Used

No. of hrs. worked

P.O.L. issued Diesel—Lits.

Lubricants—Lits.

—Lits.

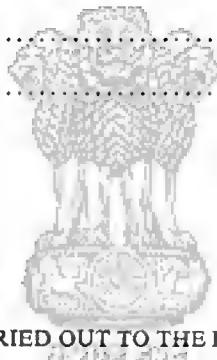
—Lits.

Defects noted during operation

Idle hours

Break-down hours

Reasons for breakdown

**APPENDIX 9.3.2****DAILY REPORT OF REPAIRS CARRIED OUT TO THE EQUIPMENT GIVEN ON HIRE**

Equipment Code No. Date

Name of Lessee Shift

Spare parts used for repairs	Cost	Man-hours spent on repairs	Cost	Other material or work done	Cost
1	2	3	4	5	6

DAILY MAINTENANCE REPORT

Equipment Code No. Date

Name of Lessee. Shift

Detail of maintenance done during the day.

Daily 50 hrs. 100 hrs. 500 hrs. 1000 hrs.

Details of adjustment done during the day.

Engine	Transmission	Clutch	Final Drive	Under Carriage	Body	Other parts.
--------	--------------	--------	-------------	----------------	------	--------------



Report on Performance of different components of equipment.

Indicate measurements when wear limits are to be checked.

Engine	Transmission	Clutch	F.D.	Under Carriage	Body	Other parts.
--------	--------------	--------	------	----------------	------	--------------

PREVENTIVE MAINTENANCE

I--DAILY SCHEDULE FOR I.H. 100 PAYHAULERS

DATE..... PAYHAULER NO.

TOTAL PROGRESSIVE HOURS.....

Description	Tick	Remarks, if any
STAGE-I		
(a) Wash		
(b) Clean the glass surfaces (windshield and instruments)		
STAGE-II		
(a) Fill water in radiator, check leaks and correct		
(b) Check engine oil level, add (Delvac 1330) if necessary		
(c) Check engine oil leaks and correct		
(d) Check the fluid level in the brake power cluster front and rear after cleaning the area around the filler cap. (Hydraulic Brake fluid)		
(e) Check the transmission oil		
(f) Check the hydraulic reservoir		
(g) Clean air cleaner pan		
(h) Bleed air tank		
(i) Inspect the tyres for damage inflate pressure front 50 lbs./Sq. In rear 70 lbs./Sq. In.		
STAGE-III Grease the following parts (MPG)		
(a) Drag link (front)		
(b) Drag link (rear)		
(c) Steering cylinder anchorer		
(d) Steering cylinder end		
(e) King pins		
(f) Tie rods		
(g) Hoist cylinder bearings		
STAGE-IV		
(a) Drain fuel tank sump cock		
(b) Drain fuel filter sump		
(c) Fill fuel in the tank		
Special remarks, if any :		

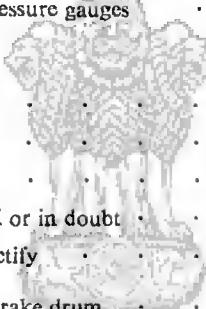
Quantity of fuel used Lubricants used	Other materials used	Name of Mechanic
1.		Signature
2.		Signature of GF/Foreman/C-man
3.		Signature of the Inspecting Officer
4.		

II. 100 HRS. SCHEDULE FOR I.H.-100 PAYHAULERS

DATE..... PAYHAULER NO.

TOTAL PROGRESSIVE HOURS.

Stage	Description	Tick	Remarks, if any
I	(a) Wash (b) Clean the Glass surfaces (Wind Shields and instruments) . . . . .	.
II	(a) Fill water in radiator, check leaks and correct (b) Check Engine Oil leaks and correct (c) Drain and refil Engine Oil (Delvac 1330) (d) Clean Crank case breather (e) Check the fluid level in the brake power cluster front and rear after cleaning the area around the filler cap. (Hydraulic Brakc Fluid) (f) Check Transmission Oil level with engine idling, add if necessary Mobile DTE oil Right Type Cl. (g) Clean Transmission breather and recoil (h) Check Hydraulic tank oil level, add if necessary and clean hydraulic breather Mobile DTE oil (i) Clean Air cleaner pan (j) Bleed Air Tank (k) Check oil level in Differential (l) Check oil level in Drive Axle (m) Check oil level in planetary reservoir (n) Check breather tube (o) Clean steering booster Breather (p) Drain compressor oil and change (q) Change lub. oil filter after every 200 hrs. (r) Change transmission oil filter after every 250 hours . . . . .	.
III	(a) Drain fuel tank sump Cock (b) Drain fuel filter sump (c) Fill fuel in the tank . . . . .	.
IV	GREASE THE FOLLOWING POINTS (MPG) (a) Drag link front (b) Radius Rod front (c) Drive line front (d) Steering Cylinder anchorer (e) Steering Cylinder end (f) King pins (g) Tie rods (h) Drag link rear (i) Radious rod (rear) (j) Drive line (rear) (k) Hoist cylinder bearings . . . . .	.

Stage	Description	Tick	Remarks, if any
V OIL CAN POINTS (Delvac 1330)			
(a) Hinge pin & Spring case	.	.	
(b) Transmission shift linkage	.	.	
(c) Hood and Battery Box fasteners	.	.	
(d) Wind shield wiper motor	.	.	
(e) Throttle linkage	.	.	
(f) Hoist control linkage	.	.	
(g) Emergency brake linkage	.	.	
VI	(a) Check the Electrolyte in Battery, add distilled water if necessary (b) Check, clean and tighten battery terminals of bracket (c) Check and oil generator and self starter (d) Check lights and switches, Correct, if necessary (e) Check and clean Generator & self starter carbon brushes, commutator (f) Check and adjust generator belt tension, replace if necessary (g) Check and adjust fan belt replace if necessary (h) Check air pressure, water temp. & oil pressure gauges	.	
VII CLEAN ENGINE AIR CLEANER			
(a) Clean Dust cap	.	.	
(b) Inspect tubes and clean with brush	.	.	
(c) Use new seal ring	.	.	
(d) Service Filter element replace if damaged or in doubt	.	.	
(e) Check hoses, gaskets for Cracks/leaks rectify	.	.	
VIII	(a) Remove mud and dirt accumulation in brake drum (b) Tighten the wheel rim clamp nuts (c) Inspect the tyres for damage pressure front 50 lbs. Rear 70 lbs.	.	

Special remarks, if any:—

Quantity of Fuel used Lubricants used	Other Materials used	Name of Mechanic
1	Signature
2	Sig. of GF/Foreman/C-Man
3
4	Signature of Inspecting Officer

PREVENTIVE MAINTENANCE

III—I.H.—100 PAYHAULER 500 HRS. SCHEDULE

DATE.....

PAYHAULER NO.....

TOTAL PROGRESSIVE HOURS.....

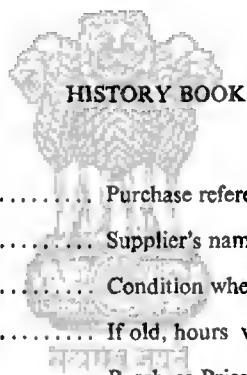
Description	Tick	Remarks, if any
STAGE-I		
(a) Wash	
(b) Clean the Glass surface (Wind shield & Instruments)	
STAGE-II		
(a) Fill water in Radiator, check leak and correct	
(b) Check engine oil leaks and correct	
(c) Drain and refill engine oil (Delvac 1330)	
(d) Clean crankcase breather	
(e) Check the fluid level in brake power cluster front and rear after cleaning the area around the filler cap (Hydraulic Brake Fluid)	
(f) Change the oil in transmission (Mobile DTE oil Light type C1)	
(g) Clean transmission breather and recoil	
(h) Check hydraulic tankoil level, add if necessary and clean hydraulic breather (Mobile DTE oil)	
(i) Remove the complete Air cleaner & Clean	
(j) Bleed Air tank	
(k) Drain Compressor oil and change	
(l) Clean the compressor housing and impeller of turbo-charger	
(m) Check oil level in differential	
(n) Check oil level in drive axle	
(o) Check oil level in planetary reservoir	
(p) Check differential breather tube	
(q) Clean steering booster breather	
(r) Change lube. oil filter after every 200 hours.	
(s) Change transmission oil filter after every 250 hrs.	
STAGE-III		
(a) Drain fuel tank sump cock	
(b) Drain fuel filter sump	
(c) Fill fuel in the tank	
STAGE IV—GREASE THE FOLLOWING POINTS (MPG)		
(a) Drag link (front)	
(b) Radius rod (front)	
(c) Drive line (front)	
(d) Steering cylinder anchoror	
(e) Steering cylinder end	
(f) King pins	

Description	Tick	Remarks, if any
(g) Tie Rods	
(h) Drag Link (rear)	
(i) Radius rod (rear)	
(j) Drive line (rear)	
(k) Hoist cylinder bearing	
(l) Lubricate the engine transmission	
STAGE-V		
OIL CAN POINTS (DELVAC 1330)		
(a) Hinge pin and spring case	
(b) Transmission shift linkage	
(c) Hood & Battery box fasteners	
(d) Wind shield wiper motor	
(e) Throttle linkage	
(f) Hoist control linkage	
(g) Emergency brake linkage	
(h) Door hinges	
(i) Door striker plates and latches	
STAGE-VI		
(a) Check the electrolyte in Battery, add distilled water if necessary	
(b) Check clean and tighten battery terminals and bracket	
(c) Check lights and switches, correct if necessary	
(d) Check generator and self starter. Lubricate with oil can (Delvac 1330)	
(e) Check and clean Generator and self starter carbon brushes, commutator	
(f) Check and adjust generator belt tension, replace if necessary	
(g) Check and adjust fan belt, replace if necessary	
(h) Check air pressure, water temp. and oil pressure gauges	
STAGE-VII		
CLEAN ENGINE AIR CLEANER		
(a) Clean dust cap	
(b) Inspect tubes and clean with brush	
(c) Use new seal ring	
(d) Service filter Element, replace if damaged or in doubt	
(e) Check hoses, gaskets for leaks/cracks and rectify	
STAGE-VIII		
(a) Remove mud and dirt accumulation in brake drum	
(b) Tighten the wheel rim clamp	
(c) Inspect the tyres for damages. Inflate pressure front 50 lbs./Sq. In. Rear 70 lbs. Sq. In.		
(d) Check the torques of front axle and drive axle spring bolts (front axle 'U' Bolts Nuts 450 to 500 ft. Lbs, Drive axle 800 to 900 ft. Lbs.)	
STAGE-IX		
(a) Adjust the valves and injector	

Special remarks, if any:

Quantity of Fuel/Lubricants used	Other materials used	Name of Mechanic
1.	Sig.
2.	Sig. of GF/Foreman/C-Man
3.
4.	Signature of Inspecting Officer

APPENDIX 10·2



1. <i>History Card.</i>	
Equipment Code No.	Purchase reference
Description	Supplier's name
*Capacity	Condition when purchased
Shipping Wt.	If old, hours worked when purchased
Overall dimensions:	Purchase Price :
Length	
Width	C.I.F.
Height	Customs duty
Wheel base	Taxes
Turning radius	Freight & Handling
Ground clearance	Total

Equipment life	Years	Hours	Weight distribution		Empty	Loaded
			Front	Drive		
Tyre life	Front	.....	.....	.....
			Drive	.....	.....	.....
			Trailer	.....	.....	.....

* Capacities may be indicated as Bucket Capacity, lifting capacity, carrying capacity, drawbar Pull etc.

19—4 CW & PC/ND/75

Details of Components :—

<i>Engine/Motor</i>	<i>Injectors</i>	<i>Compressors</i>
Make	Type	Type
Model	Make	Make
Sl. No.	Sl. No.	Sl. No.
No. of Cylinders	Pressure	Pressure
Cycles	<i>Starting System</i>	<i>Dynamo/Alternators</i>
R.P.M.	Type	Make
H. P. /K. W.	Make	Sl. No.
Max. Torque/Volts	Model	K. W.
Compression Ratio	Sl. No.	
<i>Super Charger/Turbo Charger</i>	<i>Generator (Main)</i>	<i>Other Motors</i>
Make	Make	Make
Model	Sl. No.	Type
Sl. No.	K. W.	Sl. No.
<i>Battery</i>	Volts	H.P./K.W.
Nos.	<i>Suspension</i>	Torque/Volts
Size	Type	<i>Control Type</i>
Make	<i>Fuel Pump</i>	
Volts	Type	
Amp. Hour	Make	<i>Transmission</i>
<i>Hydraulic Pump</i>	Sl. No.	Type
Make	<i>Steering</i>	Make
Sl. No.	Type	Model
<i>Brakes</i>	<i>Specification of Grease</i>	Sl. No.
Type	1	No. of speeds
	2	Forward
<i>Tracks</i>		Reverse
No. of shoes	3	<i>Max. travel speed</i>
Length	<i>Liquid Capacities & Speci-</i>	Forward
	<i>fication</i>	1
Width	<i>Cooling system</i>	2
	<i>Fuel tank</i>	3
Ground contact	<i>Engine Crank</i>	4
	<i>Case</i>	5
No. of Rollers	<i>Starting Engine</i>	
Track	<i>Crank Case</i>	Reverse
	<i>Transmission</i>	
Carrier	<i>Final drive</i>	1

Tyres	Hydraulic tank			2	.....	.....
				3	.....	.....
Type	F	D	R	<i>Filters Type & Nos.</i>		
Size				Air	.....	1.
Mos.				Fuel	.....	2.
Make				Lub.	.....	3.
Pressure				Transmission	.....	4.
				Hydraulic	.....
				Others	.....

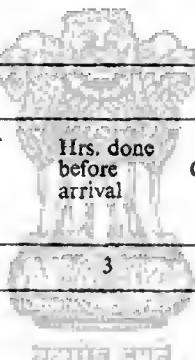
*Capacities may be indicated as Bucket Capacity, lifting capacity, carrying capacity, drawbar Pull etc.

2. Details of Accessories, Tools and Literature received with the equipment

Sl. No.	Description	Quantity	Available at	Remarks

3. Record of Transfer

Name of Project/Division	Date of Arrival	Hrs. done before arrival	Condition	Date of Transfer	Hrs. done upto the date of Transfer	Condition
1	2	3	4	5	6	7



4. Details of Alteration/Modification

Date	Hour-meter reading/ Clock-hours done	Details of Modifications/ Alterations carried out	Details of Spare Parts/ Materials used	Job Cost	Remarks
1	2	3	4	5	6

5. Details of Spare parts consumed component-wise

* (a) Engine (b) Transmission (c) Clutch (d) F.D. & U.C. (e) Attachments and other components

Date	Hour meter or Clock meter reading	Details of spare parts used	Quantity	Cost
1	2	3	4	5

* Separate sheets should be maintained for each component.

6. Details of Assemblies Replaced

Date	Hr. Meter/Clock hour reading	Assembly replaced	Sl. No. & Part No.	Old Assembly discarded or sent for repairs	Date/hr. meter reading when old Assembly is returned for replacement	Remarks
1	2	3	4	5	6	7

*7. Details of Repairs/Replacements carried out to different components and cost of repairs*

* (a) Engine (b) Transmission (c) Clutch (d) Final Drive (e) Under Carriage (f) Attachments and/or other components

Date	Mfr's Sl. No. of Unit installed	Working hrs. of unit removed or repaired	Nature of repairs	Expenditure on Repairs				Total	Removed unit if not reinstalled retd. to
				Spare parts	Labour	Other materials	Workshop Overhead		
1	2	3	4	5	6	7	8	9	10

* Separate sheet should be maintained for each component.

8 a. Tyres & Tubes |

Date of installation/replacement	Tyre position	Tyre No.	Make	Type & PR	Condition Retreaded/ Repaired/ New/Old	Hours worked by repaired tyre	Cost of repairs/ replacement	Reasons
1	2	3	4	5	6	7	8	9

8 b. Batteries

Date of replacement	Battery No.	Make	Specifications	Condition New/reconditioned/recharged	Reasons for replacement	Hours done	Cost of repairs or replacement	Remarks
1	2	3	4	5	6	7	8	9

8 c. Wire Ropes—Position—Scheduled Size, Length & Formation

Date of replacement/installation	Make	Hours done since last replacement	Cost	Time taken for replacement	Remarks
1	2	3	4	5	6

8 d. Cutting Edges/Dipper Teeth etc.

Date of installation/replacement	Make	Condition New Rebuilt	Reasons for replacement	Hrs. done before replacement	Cost of rebuild/replacement	Remarks/Observations about rate of wear etc.
1	2	3	4	5	6	7

9. Monthly Record of Hours Worked and Consumption analysis

Year.....	Month	Available hours	Hrs. worked	Hrs. under repairs	Stand-by hrs.	Consumption of				Normal/abnormal	Reasons for abnormality	Action taken	Remarks				
						Fuel		Lubricants									
						Total	Per Hr.	Total	Per Hr.								
1	2	3	4	5	6	7	8	9	10	11	12	13					

10. Yearly record of depreciation and repairs costs

Installed Cost

Rate of Depreciation

Life

Years

Years	Hours worked	Amount of depreciation	Residual value	Repairs Cost		Remarks
				Spares	Labour	
1	2	3	4	5	6	7

11a. Condition of parts and components after overhaul/repairs

<i>Engine</i>	1st.	2nd.	3rd.	4th.
No. of Overhaul				

Date of commencement

Date of completion

Clock hour/hour meter reading

Condition of parts after overhaul

Crank Shaft

- (i) Main
- (ii) Big end

Pistons

Rings

Camshaft

Head Cylinder

Block Cylinder

Fuel pump

Injectors

Turbocharger/Supercharger

Compressor

Radiator

Lub. Oil Pump



1st. 2nd.

3rd. 4th.

11 b. Track Components

No. of Overhaul

Date of commencement

Date of completion

Clock hour/hr. meter reading

Condition of Parts

Sprocket

LH

RH

Idler

LH

RH

Track Links

LH

RH

Track Rollers

Carrier ,,

Grouser Shoes

HISTORY BOOK
PREVENTIVE MAINTENANCE

Equipment Code No..... Check Every month

*Component — Under Carriage, Idler, Sprocket & Carrier Rollers

Make.....

Date of installation..... Condition when installed New/Rebuild/Old used

Wear Limits.....

Hour Meter/Clock hour readings at the time of checking	No. of checkings											
	1st		2nd		3rd		4th		5th		6th	
LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	

No. of Readings

1

2

3

Observations

Normal/Abnormal

Recommendations

Officer-in-Charge P.M.

Action taken on Recommendation.

Foreman

*Separate sheet should be maintained for each component of Under Carriage.

HISTORY BOOK
PREVENTIVE MAINTENANCE

Equipment Code No..... Check Every month

*Component — Under Carriage, Links, Bushings & Track Roller

Make.....

Date of installation..... Condition when installed New/Rebuild/Old used

Wear Limits

Hour Meter/Clock hour readings at the time of checking	No. of checkings											
	1st		2nd		3rd		4th		5th		6th	
LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	

No. of Readings

1

2

3

4

Wear Limits.....

Hour Meter/Clock hour readings at the time of checking	No. of checkings											
	1st		2nd		3rd		4th		5th		6th	
	LH	RH	LH	RH	LH	RH	RH	LH	LH	RH	RH	
No. of Readings	5											
	6											
	7											
Observations												
Normal/Abnormal												
Recommendations												

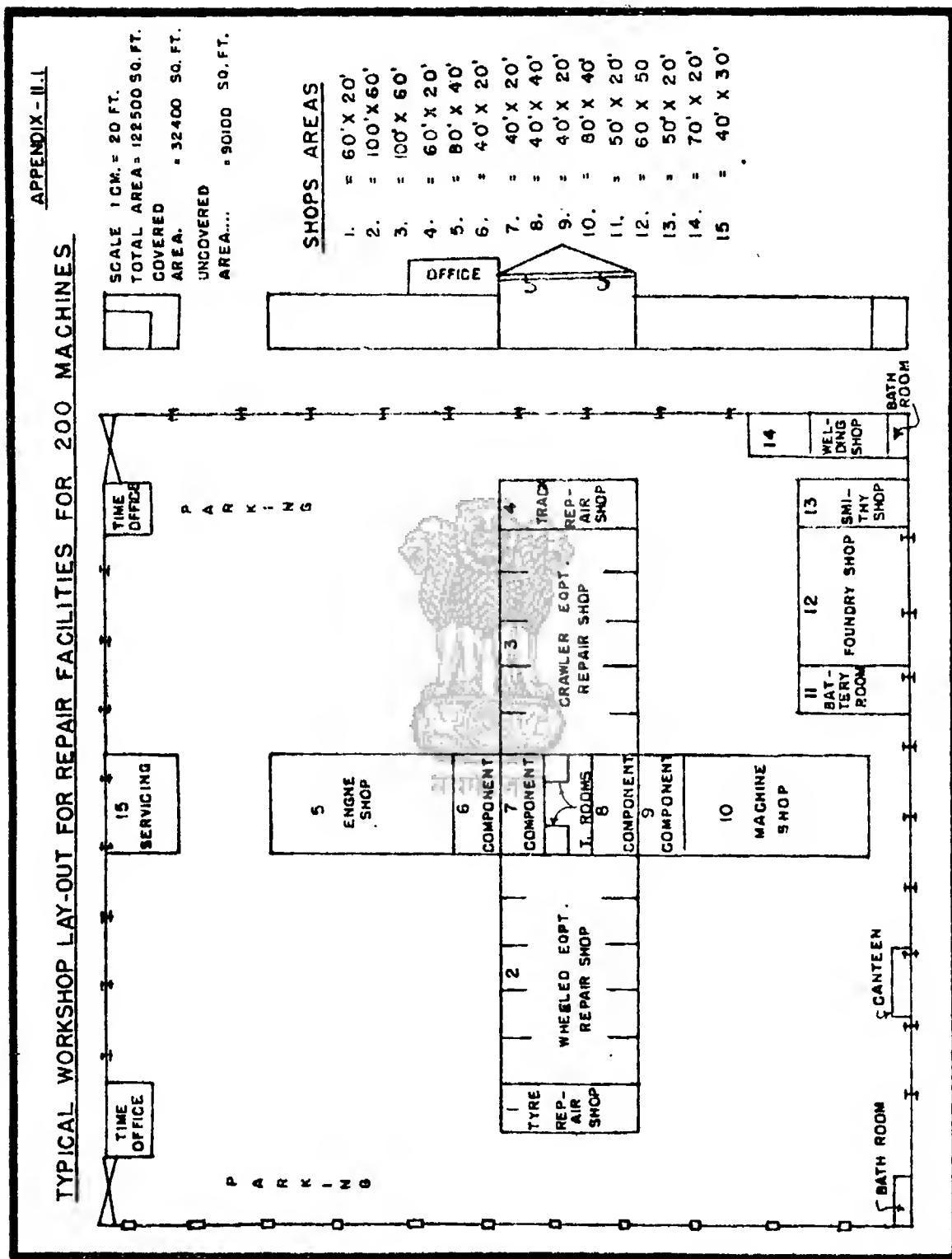
Officer-in-Charge P.M.

Action taken on Recommendation.

Foreman

*Separate sheet should be maintained for each component of Under Carriage.





A SUGGESTED SPARE PARTS STORES FOR EARTH-MOVING EQUIPMENT

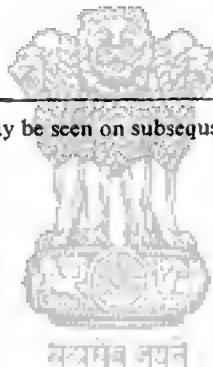
Value of Spare Parts : From Rs. 12,00,000 to Rs. 15,00,000

Area : 2,400 to 3,0000 sq. ft.

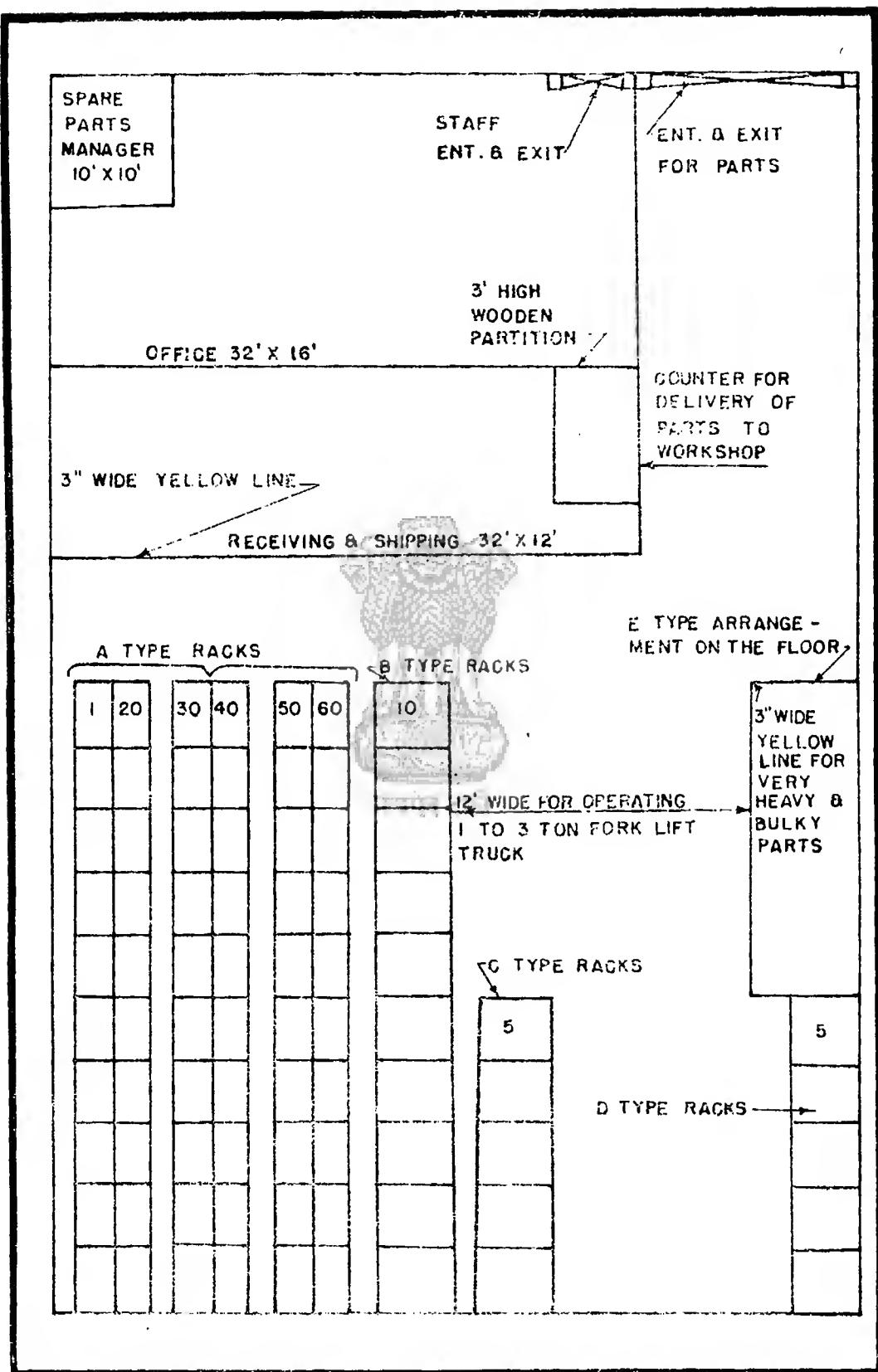
Value of Spare Parts per sq. ft. : Rs. 500.

S. No.	Types of parts and Activity areas	No. of items	Type of Racks	Details	Qty. of Racks	Area Sq. ft.
1. Small & Medium items	.	5000	A	Steel Racks (Back to Back)	60	
2. Bulky Parts	.	300	B	7'-3"×3'×18" Steel Racks 7'-3"×3'×3'	10	
3. Heavy Items	.	100	C&D	Custom Built wooden racks.	10	
4. Very Heavy and Bulky items	Total	50	E	on the floor	N.A.	1504
5. Offices		5450				512
6. Receiving & Shipping						384
				Total		2400

Note :--Sketches of various types of racks may be seen on subsequent pages.



સર્વાંગ સંપરી



STEEL RACKS : "A" Type

Height 7'-3" each angle iron to have holes at 2" intervals-centre to centre. Shelf 36"×18"—thickness 20G. Sides 7'-3"×18" and Backs 7'-3"×36" of 22 /24G. Ordinary Nuts, Bolts and Washers with 4 nos. of Gussets or Corner Flates. These should be painted olive green. Each shelf should be of Allwyn or Godrej design which would then have load bearing capacity of upto 400 lbs per shelf. Each rack would have 7 shelves—one fitted at the bottom i.e. 0', 2', 3', 4', 5', 6', and 7'-3".

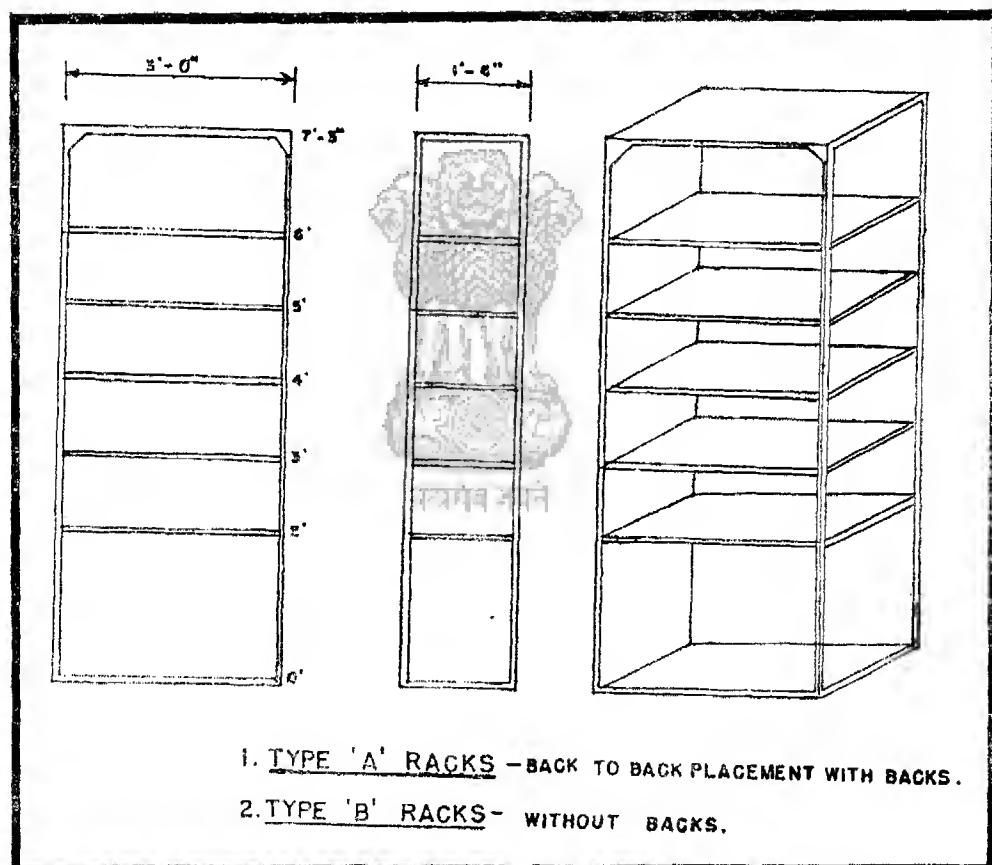
keep the racks back to back thus bins would be 36"×18"×24". and 36"×18"×12".

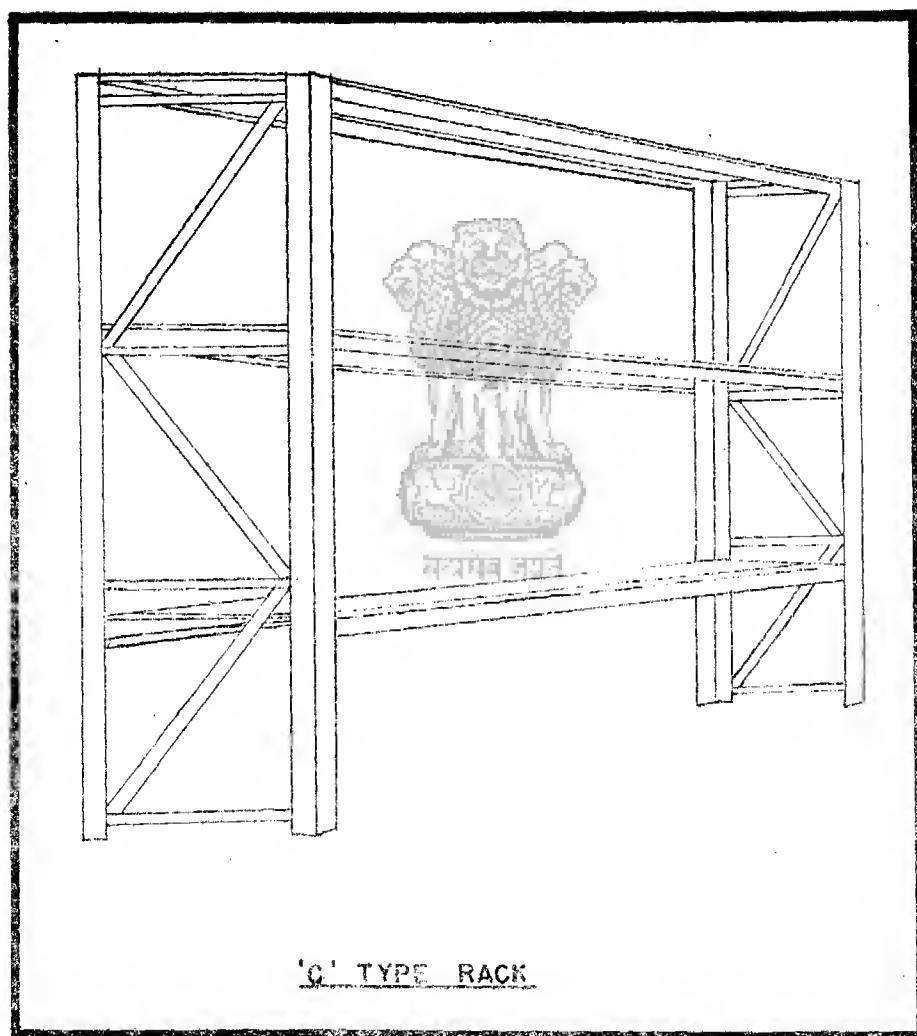
STEEL RACK : "B" Type

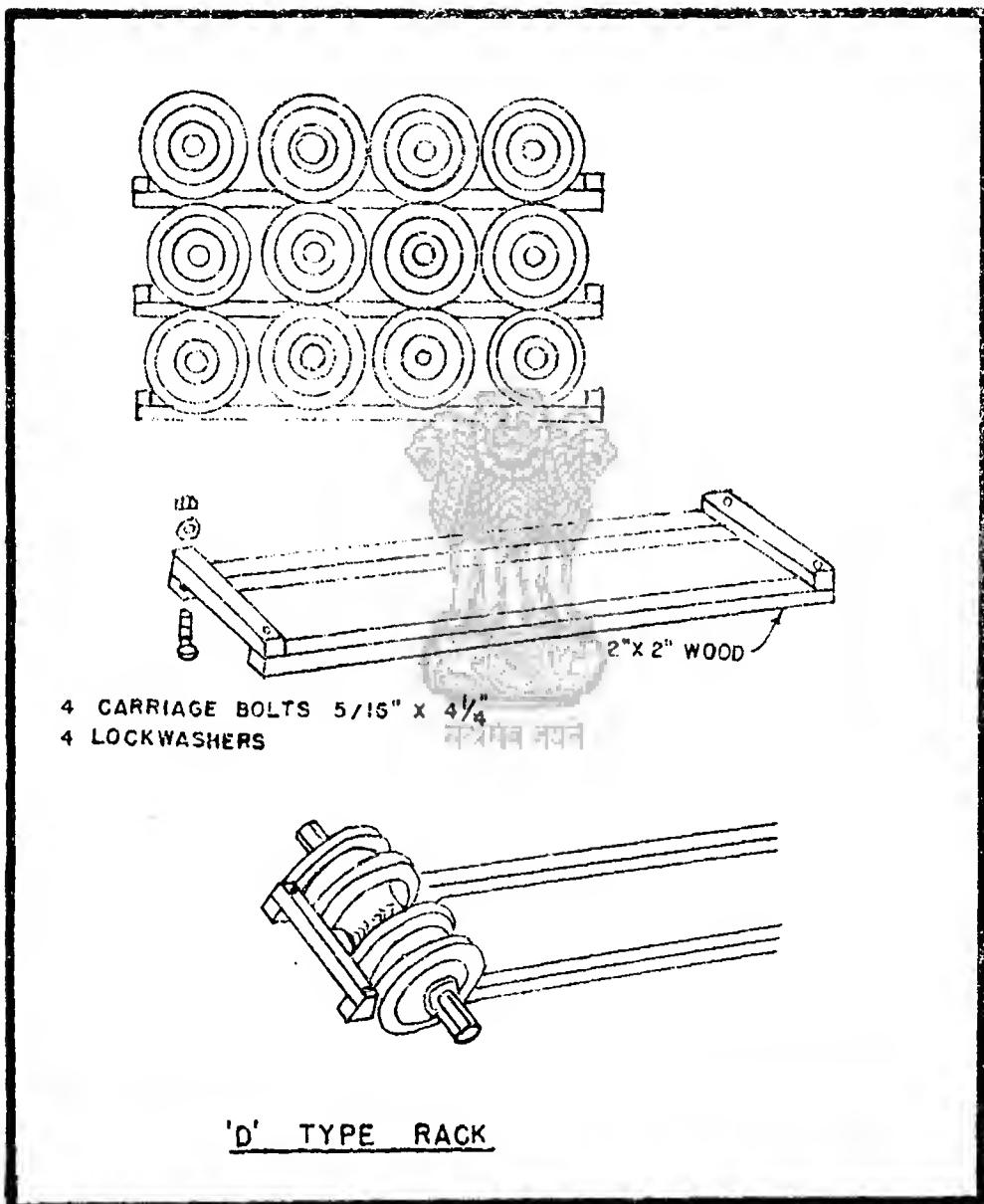
Same as above. Racks would be kept back to back except backs won't be used. Bin would be 36"×36"×24" and 36"×36"×12".

Alternative : Welded angle iron frame (7"-3" height, 3' wide and 3' deep). Wooden shelves of 1½" thickness.









APPENDIX 12·1

ITEMS OF WORK TO BE PERFORMED BY C.M.U. AS RECOMMENDED BY THE COMMITTEE OF MINISTERS

- (i) Stock taking of surplus equipment and spare parts of all Irrigation and Power Projects in each State.
- (ii) Making an assessment regarding equipment that can be readily commissioned, or repaired for useful work; and also if this can be rehabilitated on some of the Projects within the State. If not, these should be declared surplus to the CW&PC who would arrange for transfer of such machines to other needy projects under execution or earmark them for deployment on new schemes to be taken up within the owning State, or outside.
- (iii) To list out the items of equipment which cannot be economically repaired and which should be disposed of to the best advantage of the State. If necessary, assistance may be taken from the principal dealers of equipment of various makes.
- (iv) Similar exercise may be carried out in respect of spare parts which are not required for machines working within the State. Such items should be declared surplus and assistance sought from the CW&PC in diverting the surplus spare parts to other needy projects. To the extent necessary, assistance in this regard may be taken from the principal dealers of equipment/other similar service agencies who are recognised dealers of spare parts.
- (v) Periodical review be carried out in respect of the surveys made by the Central Mechanical Units on the lines indicated above. This may be done through periodical meetings of the State Mechanical Organisations on a common forum where the CW&PC can co-ordinate in the matter.
- (vi) The Mechanical Organisation in each State (in Irrigation and Power Sector) should be strengthened and the work pertaining to rehabilitation of surplus equipment and spare parts should be assigned to an Officer on Special Duty who would co-ordinate with the Central Water and Power Commission for expeditious arrangements to rehabilitate the equipment etc.

APPENDIX 12·2

QUESTIONNAIRE AS ISSUED AND STATE-WISE REPLIES RECEIVED REGARDING THE POSITION OF C.M.U.

Q-1. When was the Central Mechanical Organisation established in the State ?

<i>Andhra Pradesh</i>	•	•	•	w.e.f. 23-10-1963.
<i>Assam</i>	•	•	•	No C.M.O. is functioning in the State nor the proposal for establishing the Organisation is under consideration of the Govt. of Assam.
<i>Bihar</i>	•	•	•	There is no separate C.M.O. in the State. Irrigation Mechanical Circle, Patna started functioning w.e.f. February, 1961 in the River Valley Projects Department to perform a part of the functions of Central Mechanical Organisation.
<i>Gujarat</i>	•	•	•	w.e.f. 2-1-1961.
<i>Haryana</i>	•	•	•	A new Central Mechanical Organisation has been opened recently at Karnal under the Superintending Engineer Construction Circle No. 1. The Organisation is not yet fully established and it will take some more time to perform the functions assigned to the Organisation.
<i>Kerala</i>	•	•	•	w.e.f. 4-7-1964. Proposals for activating the C.M.O. have been forwarded to the Chief Engineer. Some of the suggestions have been accepted and are being implemented when all the suggestions are accepted it will be possible for the Central Mechanical Organisation to play a more effective role in the execution of projects, proper maintenance and effective utilisation of equipment.
<i>Madhya Pradesh</i>	•	•	•	There is no separate C.M.O. in the State.
<i>Maharashtra</i>	•	•	•	w.e.f. July, 1959.
<i>Mysore</i>	•	•	•	w.e.f. 2-4-1963.
<i>Orissa</i>	•	•	•	There is no separate C.M.O. in the State. One post of Assistant Engineer was sanctioned under the Superintending Engineer, Mech. Circle, Hirakud to assist in the work relating to C.M.O. w.o.f. September, 1961.
<i>Rajasthan</i>	•	•	•	Necessary proposals for setting up a C.M.O. in the State are under consideration with the State Govt.

Tamil Nadu • The functions of the C.M.O. is being looked after by a Central Mechanical Circle created on 1-4-1968.

Uttar Pradesh • No C.M.O. has been established. The Superintending Engineer, Central Equipments and stores procurement Organisation Irrigation Department, Lucknow, has been partially performing the functions of C.M.O. A disposal unit was created on 28-10-1970 which is dealing mostly audit paras and audit inspection reports relating to surplus stores, survey report and auction cases of surplus stores.

West Bengal • No information received.

Q-2. How much surplus equipment (by value and in number of pieces with details of equipment) has been rehabilitated within the State on different projects?

Andhra Pradesh • No. of items 276. Value Rs. 2,46,81,000/-

Assam • Not indicated.

Bihar • No. of items 31. Value Rs. 19.85 lacs] from July 71 to Oct. 71.

Gujarat • No. of items 89. Value Rs. 36 lakhs.] During the calendar year 1971.

Haryana • Not indicated.

Kerala • No machine has so far been declared surplus.

Madhya Pradesh • No. of items 434. Value Rs. 304.45 lacs.

Maharashtra • No machine has so far been declared surplus.

Mysore • No information with CMO. The concerned Chief Engineers watch the performance of equipment and arrange rehabilitation separately.

Orissa • Value Rs. 159.85 lacs--from 1958 to 4/1971.

Rajasthan • Not indicated.

Tamil Nadu • Not indicated.

Uttar Pradesh • Not indicated.

Q-3. What is the average time taken for such rehabilitation of surplus equipment after its being rendered surplus on one of the completed projects or where, due to completion of a particular item of work, it was no longer required ?

Andhra Pradesh • 3 months to two years.

Assam • Not indicated.

Bihar • One to six months and in some special cases even more depending on the extent of repairs.

Gujarat • Generally within 3 months in the case of working equipment.

Haryana • Not indicated.

Kerala • Correct details of time taken for rehabilitation are not available.

Madhya Pradesh • One week to a few months.

Maharashtra • Every year plans are prepared in advance for redistribution of equipment on various works in the State.

Mysore • Not in a position to indicate as the control of the machines are with concerned Chief Engineer.

Orissa • Not indicated.

Rajasthan • Not indicated.

Tamil Nadu • Not indicated.

Uttar Pradesh • Not indicated.

Q-4. How much equipment, by value and number, had to be disposed of to the best advantage of State?

Andhra Pradesh • Not indicated.

<i>Assam</i>	•	•	•	•	Not indicated.
<i>Bihar</i>	•	•	•	•	Not indicated.
<i>Gujarat</i>	•	•	•	•	One double housing planning machine costing about Rs. 2 lacs is being disposed of by Public Auction at present. Until now no working equipment has been disposed of by Public auction.
<i>Haryana</i>	•	•	•	•	Not indicated.
<i>Kerala</i>	•	•	•	•	Correct value and numbers could not be furnished.
<i>Madhya Pradesh</i>	•	•	•	•	94 Nos.—Purchase value 70·107 Present/disposal value 12·61
<i>Maharashtra</i>	•	•	•	•	52 Nos. Value—Rs. 41.40 lacs.
<i>Mysore</i>	•	•	•	•	The C.M.O. has been acting only in an advisory capacity to find out whether any machine which has developed sickness could be repaired at an economical cost or it could be declared as scrap etc.
<i>Orissa</i>	•	•	•	•	Not indicated.
<i>Rajasthan</i>	•	•	•	•	Not indicated.
<i>Tamil Nadu</i>	•	•	•	•	Not indicated.
<i>Uttar Pradesh</i>	•	•	•	•	Not indicated.

Q-5. How much equipment, by value and number, was transferred, or rehabilitated on projects or works outside the State?

<i>Andhra Pradesh</i>	•	•	•	•	One No. elevating grader and one No. Motor grader was under the process of transfer outside the State. Value of these items was about Rs. 1,20,000/-
<i>Assam</i>	•	•	•	•	Not indicated.
<i>Bihar</i>	•	•	•	•	Not indicated.
<i>Gujarat</i>	•	•	•	•	During calendar year 1971, no equipment of State P.W.D. has been transferred or rehabilitated outside the State.
<i>Haryana</i>	•	•	•	•	Not indicated.
<i>Kerala</i>	•	•	•	•	Correct value and numbers could not be furnished.
<i>M.P.</i>	•	•	•	•	Not indicated.
<i>Maharashtra</i>	•	•	•	•	No equipment has been transferred outside the State.
<i>Mysore</i>	•	•	•	•	The Central Mechanical Organisation was not kept informed regarding the equipment transferred or rehabilitated on projects outside the State.
<i>Orissa</i>	•	•	•	•	Not indicated.
<i>Rajasthan</i>	•	•	•	•	Not indicated.
<i>Tamil Nadu</i>	•	•	•	•	Not indicated.
<i>U.P.</i>	•	•	•	•	Not indicated.

Q-6. What is the organisational set up of the Central Mechanical Organisation and the functions being performed, which may include :

- (i) Census of equipment
- (ii) Census of spare parts available on various projects in the State.
- (iii) Purchase of equipment and Spare Parts.
- (iv) Inventory Control of Spare Parts.
- (v) Rehabilitation and disposal of surplus equipment.
- (vi) Organisation of Central, Regional and Field Workshops and Stores.

<i>Andhra Pradesh</i>	•	•	•	•	The Central Mechanical Organization is kept in charge of pool machinery purchased under minor and medium pool. All the records pertaining to these pools, and census of machinery purchased under the above pools, stock account, collection of hire charges, purchase of spare parts required are being maintained. Rehabilitation and disposal of machinery is being done by a separate Committee known as "Screening Committee" constituted by the Govt. during the year 1968. The Committee recommends the purchase of new machinery only. When the requirements cannot be met from the available surplus machinery. The surplus equipment is brought to C.M.O. and then issued to the needy projects.
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The C.M.O. is also doing the overhauling of machinery in the pool.

Most of the machinery under Irrigation Branch are owned by this Organisation. Those machines are issued to other projects/divisions on hire basis. The field workshop at irrigation Projects/Organisations function under this organisation.

- Assam* • Not indicated.
- Bihar* • There are four Executive Engineers (Mech.) under the S.E. Mech. Circle, River Valley Projects Department, Patna.
- Gujarat* • The Central Mechanical Organisation is headed by a Superintending Engineer who is having four Executive Engineers under him and 12 Deputy Engineers.
 - (i) All the Officers of the P.W.D. in the State send periodical returns of inventory for machinery to Executive Engineer, Central Workshop Division, under C.M.O. These returns are then compiled. Total fleet of machinery owned by P.W.D. is approx. 3700 Nos. costing Rs. 23 crores as per inventory of 9/1971.
- Haryana* • Not indicated.
- Kerala* • There are three divisions under the C.M.O. One division is at Iddiki Project, the other at Anachal and the third division the Civil Branch Central Stores division at Pallom. The third division is dealing with all stock items required for the project works, repaired machines received from workshop, new stocks or stores in the Central Stores.
 - (i) Census of all T & P under the Civil wing was prepared in 1969 and a master record indicating condition, location etc. was also prepared.
 - (ii) A list of spare parts in Stock at all stores was also prepared.
 - (iii) Purchase of all new items of spare parts and equipment is being arranged by Chief Engineer Civil.
 - (iv) Inventory control of spare parts of 22 Mogurt Dumpercs was introduced as a trial measure with cardex system. This was not extended to other equipment as identical machines are few in numbers.
 - (v) Assessment regarding rehabilitation and disposal of surplus equipment has not been made.
 - (vi) One Central Workshop at Kulamavu and one field workshop at Moolamattom are now functioning. One central workshop under Mechanical service unit at Anachal is also functioning. Each division is having separate divisional stores.
- Madhya Pradesh* • The Superintending Engineer, E&M, Raipur with five E&M Divisions and 17 sub-divisions is looking after the work of Central Mechanical Organisation. There is a proposal to set up a Central Workshop at Bhopal worth Rs. 333.81 lacs.
- Maharashtra* • There are 3 Superintending Engineers in the Mechanical Organisation of the State.

Two Superintending Engineers are dealing with operation, maintenance and repair to various machines under their control and the third Superintending Engineer dealing with the work of manufacture and erection of Radial and Sluice Gates and Hoists required for the various Projects in the State—

A Central Pool of Machinery has been formed in the State and the same is controlled by the C.M.O. Every year in the month of June census of the machinery existing on various projects is taken and a programme is drawn up for its utilisation on the various projects as per the quantities of earth work to be executed in the working season beginning from Oct. to the end of June of the next year. Machinery surplus to the requirement is arranged for rehabilitating to other projects where the same is needed.

There is one Centralised Mechanical Stores Division at Dapuri, Poona which looks after:—

 - (i) Planning and advance procurement of spare parts.
 - (ii) Procurement in bulk quantities of misc. materials required for operation, maintenance and repairs of machinery.
 - (iii) Planning and procurement of steel.
 - (iv) Procurement of import licenses for spares and materials.
 - (v) Inventory control of spares and materials stocked in the various Mechanical Stores Sub Divisions in the State.
 - (vi) Disposal of surplus spare parts and materials.

Additional requirement for the Central Pool of machinery is decided upon in the meeting of the Chief Engineers and Superintending Engineers.

Bin Card system for spare-parts and materials is followed in the Central Mechanical Stores Division, Dapuri. Ledger system is however being followed in the Mechanical Stores Sub-Division situated at various projects.

So far there has not been any equipment surplus to the State.

The State is divided into 3 regions.

In each region there is a Regional Workshop and Stores. Field Workshops are also set up on various major projects to cater for the needs of the machinery operating on these projects. There is also a proposal to set up small repair workshops at Nasik, Satara, Dhulia, Ahmednagar, Bhir and Nagpur.

Mysore • The Central Mechanical Organisation is headed by a Superintending Engineer who is having 3 Assistant Engineers and 9 Junior Engineers.

(i) Regular information is not received from the concerned section.

(ii) The C.M.O. has not received any details of the spares available as surplus with other projects.

(iii) Every zone is having its own set up to plan and purchase the equipment, as well as spare parts. The Central Mechanical Organisation has been doing this job in the case of zone of Chief Engineer/North/only.

(iv) The C.M.O. is not having any inventory of the spare parts available in the State. The C.M.O. is not consulted for purchase of spares.

(v) The Services of the C.M.O. are not availed of for disposal/rehabilitation.

(vi) A proposal to have regional workshops at K.R.S. Mysore and Central workshop at Bangalore have been under consideration.

Orissa • The Govt. of Orissa constituted a CPM Committee to look into the allotment and effective use of surplus Plant and equipment at Hirakud.

Rajasthan • Not indicated.

Tamil Nadu • Not indicated.

Uttar Pradesh • Not indicated.

Q-7. Has the Central Mechanical Organisation played an effective role in execution of work in any of the medium projects, or in providing means of supply of equipment, on "as required basis", for minor works, or smaller items of work? In brief, has the Equipment Pool being operated under the Central Mechanical Organisation.

Andhra Pradesh • It can be said that C.M.O. has played and is playing an effective role in providing means of supply of machinery to Pochampally Project.

Assam • Not indicated.

Bihar • A good No. of medium scheme such as Sivapur Dam, Patna Town Projection Embankment Scheme, Horway Dam, Kolmahado Dam, Barehiya Drainage Channel, Amritiy and Sikhandi Dams, Siharsi Dam and Chandam Dam have been completed with the help of earthmoving equipment under the guidance of Mech. Circle, Patna which is functioning as Central Mechanical Organisation.

Gujarat • Planning and requirements for major irrigation projects is done by C.M.O. Planning for Ukai, Dantiwada etc., was also done by Central Mechanical Organisation. Planning of requirement of machinery for medium projects in Saurashtra and Kutch region is done by a separate Mechanical Circle and not by the Central Mechanical Organisation.

Haryana • Not indicated.

Kerala • The Central Mechanical Organisation has contributed much and played important and effective role in execution of project works. The supervision of all types of mechanical works, operation and maintenance of project machines and construction plants are being done by this unit.

Madhya Pradesh • A lot of projects have already been completed.

Maharashtra • The Central Pool of Machinery was created under the Mechanical Organisation from 1-4-1967 for execution departmental Major and Medium Irrigation Projects in the State. Earthwork in all Major Irrigation Projects and to many a Medium Projects is being executed by the Mechanical Organisation in addition of some Minor Irrigation works also.

Yearwise earth work executed by the Mechanical Organisation is as under:—

1966-67	236.78	M. cft.
1967-68	222.00	Do.
1968-69	243.65	Do.
1969-70	271.98	Do.
1970-71	276.57	Do.

<i>Mysore</i>	•	•	•	•	The C.M.O. is not having any division under its direct control nor this office is being consulted for the purpose of working out the cost of production. The C.M.O. is not having any machinery under its control and as such, it has no opportunity to play any part in the execution of works in any of the projects.
<i>Orissa</i>	•	•	•	•	Not indicated.
<i>Rajasthan</i>	•	•	•	•	Not indicated.
<i>Tamil Nadu</i>	•	•	•	•	Not indicated.
<i>Uttar Pradesh</i>	•	•	•	•	Not indicated.
Q-8. Has the work of planning for equipment for any medium projects; or for any other item of work where equipment is required, been done by the Central Mechanical Organisation ? If so, kindly give brief details.					
<i>Andhra Pradesh</i>	•	•	•	•	No planning for equipment for any medium projects for any other items of work has been done by the Central Mech. Organisation.
<i>Assam</i>	•	•	•	•	Not indicated.
<i>Bihar</i>	•	•	•	•	Planning of plants and equipment for Gandak and Sone Barrage and Tennughat Dam were done by the C.M.O. Planning of construction equipment is now being done by this Office for the projects of Irrigation Departments.
<i>Gujarat</i>	•	•	•	•	The C.M.O. has major function of establishment of workshop schemes in the State.
<i>Haryana</i>	•	•	•	•	Not indicated.
<i>Kerala</i>	•	•	•	•	There is a planning wing working in Chief Engineer's Office, Assessment of preliminary requirements of machinery are formulated in Chief Engineer's Office. Additional requirements of machineries and equipment are furnished by C.M.O. Technical advice regarding selection of equipment is given by C.M.O. when called for.
<i>Madhya Pradesh</i>	•	•	•	•	All planning for equipment for medium projects is done by the circle as a part of the duties of C.M.O.
<i>Maharashtra</i>	•	•	•	•	The work of planning of the equipment required for the various major, medium and minor projects in the State is being done by the Mech. Organisation. Machinery valued at Rs. 1129.41, purchased from 1967 to 1971 was planned by the Mech. Organisation. The Organisation also carried out the inspection of unserviceable machinery belonging to the departments/projects other than the Irrigation and Power Sector.
<i>Mysore</i>	•	•	•	•	The Central Mechanical Organisation is not being consulted by any Chief Engineer for planning the requirements of earthmoving equipment for their projects—major, medium or minor. Therefore, the Organisation had no occasion to plan the requirements.
<i>Orissa</i>	•	•	•	•	Not indicated.
<i>Rajasthan</i>	•	•	•	•	Not indicated.
<i>Tamil Nadu</i>	•	•	•	•	Not indicated.
<i>Uttar Pradesh</i>	•	•	•	•	Not indicated.

APPENDIX 12.3**NOTE ON PROCEEDINGS OF THE C.P.M. COMMITTEE IN ORISSA STATE**

1st Meeting	— Rehabilitation of Earth Moving Machineries, conversion of Hirakud Workshop to a Manufacturing Unit and disposal of items from Hirakud Stores.
22-12-1961	
2nd Meeting	— Fixation of Sale value of machineries, procurement of Spares for overhauling of machines, Disposal of unserviceable vehicles, Machines, Stores and recognition of Plant and Machinery Committee.
27-4-1962	
3rd Meeting	— Old items. H.L.O. & Darjang Machineries, Release of surplus materials to parties within and outside the State. Fixation of Hire charges and depreciation values of machineries working in Darjang Project for I.D.C.
6-4-1963	
4th Meeting	— Old items. Formation of Central Pool of E.M.M., fixation of issue rate and procedure for release of machinery, materials etc. from Central Store.
18-12-1963	

5th Meeting	Old items, fixation of issue rates for Stock, Tools and Plant items, issue of materials to Government Departments, Undertakings and local bodies and other Governments.
7-7-1975	
6th Meeting	Review of Action taken so far. Suspension of repair work of all machines, time given for lifting of the released machinery—one month. The F.A. & C.A.O., Hirakud Dam Project to intimate the Government in the Irrigation and Power Department about the defaulters.
28-11-1967	
7th Meeting	Review of Action taken so far. Regularisation of transactions regarding machines issued to Durjang project. Disposal of scrap and surplus pumping sets.
Scheduled on dated 30-12-1967 but postponed.	

APPENDIX 12·4

GUIDELINES FOR THE ESTABLISHMENT OF CENTRAL MECHANICAL UNIT AS ISSUED BY CENTRAL WATER AND POWER COMMISSION**I. Basic steps Required Prior to Setting up a Mechanical Organisation**

The first step in establishment of a Mechanical Organisation in a State is for the State Government concerned to define the sphere of operation of this organization. In some cases states have limited the sphere of the Mechanical Organization to the Irrigation and Power Sector; while in other cases, this sphere includes Building and Communications as well as the Health Department.

After the sphere of operations is defined an officer must be assigned to collect information as to the amount and types of equipment available in the State with various Organizations, as well as the probable requirements for additional equipment in the near future. In addition, the possible work load arising from requirements for structural items such as gates, penstocks, transmission line towers, hoists and gantry cranes, etc., must be assessed.

With the above information in hand, the size of the Mechanical Organization, required can be determined and an estimate made and sanctioned.

The next item to be considered is the location and disposition of various projects and important work Centres where equipment will be or is being employed. When these locations are determined, the present location of all existing workshops must be noted. It can then be ascertained if the present locations of the various workshops are readily accessible to a group of projects or work Centres. It is also essential to evaluate the present installed capacity of each workshop and gauge its possibilities for expansion. If the present layout of the workshop and the area available to them is adequate to meet the existing work-load and will fulfil future demands for expansion, it is most economical to allow the shops to remain as they are. If the sizes of the workshops and their set-ups do not afford the necessary capacity and possibilities for expansion as envisaged above, it will be necessary to consider selection of a suitable location to meet the demands of various Projects in each given area. The number of shops and stores and their layouts can then be planned for capacity as warranted by the needs. Major projects, of course, will require adequate facilities to operate efficiently.

II. Recommended Set-up for Workshops

The type of organization envisaged and at present being recommended by C.W. & P.C. is similar to that already sanctioned by two of the States, and is as follows:—

A. At the headquarters for the organization is a Central Workshop and a Central Stores through which all functioning of equipment and spares for the State concerned is controlled. All specifications for equipment including that for major projects are written by this organization. The tenders for equipment are evaluated by the Officers of the Mechanical Organization and in case of Major Projects, they work in conjunction with the project authorities to evaluate tenders. The central workshops consist of a structural shop, a machine shop and an equipment repair shop. In this equipment repair shop major overhauls are done, but, more important, this shop rebuilds all necessary components to keep the equipment running.

B. In addition to the central workshops there are regional or project shops. These shops function under the Central shops and take the components from the Central shops as needed for the concerned region or project to do the necessary major and minor overhauls and running repairs.

C. Attached to each central or regional workshop there are motorized units equipped to do all field and running repairs up to and including changing engines or tracks. These units will have to be equipped and staffed in accordance with the type of machines being cared for. (Staff and tools to repair tractors and scrapers are not the same as for draglines or shovels). In general the unit should consist of a properly equipped work truck and a jeep staffed with a supervisor or foreman, mechanics, helpers, and riggers as required. The number of motorized units with each central or regional workshop will be determined by the number of machines to be cared for.

D. In addition to A, B and C above, there should be Field Machinery Units to do lubrication, service and maintenance on small or medium projects, particularly on such works as canals, small bunds, etc. For this work these individual field units should be equipped with three drawn trailers of 5 to 7 tons capacity each. One of these will carry P.O.L. supplies, the second would carry racks for fast running spare parts, nuts, bolts, washers, screws, etc., and necessary tools required for service and maintenance. The third trailer would carry the mobile Workshop unit (equipped for both gas and electric welding). In addition to this a bowser tank 4000 to 5000 gallons capacity should carry high speed diesel oil for dispensing fuel in a clean manner to all the equipments. If these field machinery units are set up in this manner with the four pieces of portable equipment it can be confidently assumed that the breakdowns will ultimately be reduced to the minimum and maximum utilisation will be attained.

In planning this organization it is considered that the Central Workshop would undertake the rebuilding of all components for the machines in addition to doing major overhauls. Regional and project workshops would attend to major and minor overhauls and field repairs. The motorized units attached to each central or regional workshop would take care of running repairs and emergency demands arising in the course of work on medium projects and work centres whether far from or near the Central Workshops. A tentative break-up of the duties to be performed by the Central Workshops, the Regional or Project Workshops, the Motorized Units and the Field Machinery Units must also necessarily be drawn up so that the procedure is comprehensive.

To make the above possible, it is essential for the State Mechanical Organizations to do proper scaling of spares and components. It will be the duty of stores units to obtain sufficient supply of spare engines, water pumps, radiators, fuel injection pumps, track assemblies, transmissions, starter motors, generators, etc. These will be fed to the regional units which can then do major overhauls and attend to any major breakdown by replacement of major assemblies, sending back these damaged or worn components to the Central Workshops where they will be rebuilt if this proves practicable.

In order to reduce the breakdown of equipment to the minimum, it is essential that regional workshops should carry an imprest of the spare parts generally in use. Detailed lists for these spares can be prepared by officers using the equipment from the experience gained in operation of the machines. The quantities however vary from one work centre to another, depending upon the types and makes of equipment to be serviced, the standard of maintenance, and the care taken in operation of the equipment. In addition the regional and project workshops will have sizeable imprest of sub-assemblies, mountings and fittings for all types of machines in use in their areas so that they will be in a position to attend to all fieldbreakdowns rapidly by replacement of sub-assemblies. This work will, of course, be attended by the motorized units. The damaged sub-assemblies can then be repaired in the regional shops if damage is limited, or sent to the Central Workshop if complete rebuild is required.

Such organizations will have a very considerable advantage in as much as a major portion of the work can be attended to by specialists in the particular work. Senior all-round mechanics will actually only be required in the motorized units and for final inspections at the Regional and Central Workshops. All other regional workshops and project workshops will have skilled hands and semi-skilled hands trained to attend the particular machines in their area.

III. Planning For Shops and Stores

The size of the workshops having been determined, both in view of the total assessed amount of equipment to be maintained and the fabrication work to be executed, the layout of the shops must be properly planned, taking into account all necessary facilities that are normally warranted for establishing a modern setup. The principal consideration in planning a proper layout would be the convenience of material handling so that the fabrication costs and handling costs are cut to the minimum. The equipment by way of machine tools to be installed in the workshops must vary with the type of work to be done.

It must be emphasized that in this planning for the work, adequate attention must be given to procurement of all hand tools in general use in workshops; for repairs and overhaul of equipment, handling of materials, for use in machine shop, in carpentry shop and in smithy shops, as well as in the field. In determining the amount of tools required to maintain the machines adequately, the factors involved are: (1) the total amount of equipment to be maintained. In considering this, an original investment of 2% of the value of the equipment is approximately correct. (2) The number of senior mechanics involved in the maintenance, since there will have to be no less than one complete heavy duty mechanics' tool set for each senior mechanic.

Provision will have to be made for the required special tools and equipment necessary to maintain the various types of earthmoving and transport equipment. This refers to such special equipment as track presses, pullers, etc.

The above discussion amply brings out the fact that the basis of planning must be a result of the information regarding proper census of machinery in hand and that likely to be acquired by the State for work in the future. It is, therefore, vitally important this work be properly done and the first census to be taken for all the machinery in hand in the State should render full information on each machine. When this information is in hand all the machines not working should be shifted either to the location of the Central Workshops or to one of the locations selected for a Regional or Project Workshop. Here they can be torn down to determine the defects to rectify or nature of repairs required. Spare parts lists can then be compiled and processed for procurement.

It is also most essential to make a complete inventory of the existing spare parts already available. Regional stores and warehouses should be attached to the Regional or Project workshops giving due consideration to service facilities to be provided by each base supply unit to various work centres.

The main purpose of setting up the State Mechanical Organisations is to ensure the optimum utilization of Plant and Machinery, which has been heretofore somewhat unsatisfactory. This would necessitate enforcement of well laid maintenance drills yet to be suitably evolved based on standard patterns already in use. In accomplishing what is envisaged in this maintenance drill, it will be basically essential that full complement of tools and lifting tackle, etc., are adequately provided for.

IV. Necessity For Inspection Organization

The functioning of the various units described above would not be perfect unless an inspection organization is established under the aegis of the State Mechanical Organization. The officer to be deputed must be personally responsible to the Engineer In Charge of the State Mechanical Organization, who should take suitable action after evaluation of the position as reported by the Inspection Officers. In case of machinery working with major projects, the Engineer In Charge of the State Mechanical Organization may have to carry out such inspections personally. It goes without saying that the Engineer In Charge of the Central Mechanical Organization must have control of all the machines within the sphere of operation of the Central Mechanical Organization; while he may not have control of allotment of machines to major projects, good results will require that he at least have technical supervision of the machines.

V. Training Personnel

The present difficulties involved in obtaining suitably qualified mechanical staff brings to notice the problem of providing training facilities for officers, formen, mechanics, etc. The existing Training Centres under the CW&PC can afford this facility to a limited extent. In addition, a suitable training programme can be usefully and systematically introduced for this purpose in the Central Workshops established in each State. This would afford the additional facility of training specialists in operation and mechanical work and gradually distributing them to the various regional work centres for better use. This will contribute substantially towards a solution of the difficult problem involved in obtaining skilled staff for mechanical work. In some cases additional training facilities may be within easy reach in the industrial undertakings and industrial training centres.

VI. Additional Advantages Resulting From the Establishment of C.M.Os.

If planning is done in the correct fashion, certain additional advantages can result from the establishment of these Central Mechanical Organizations.

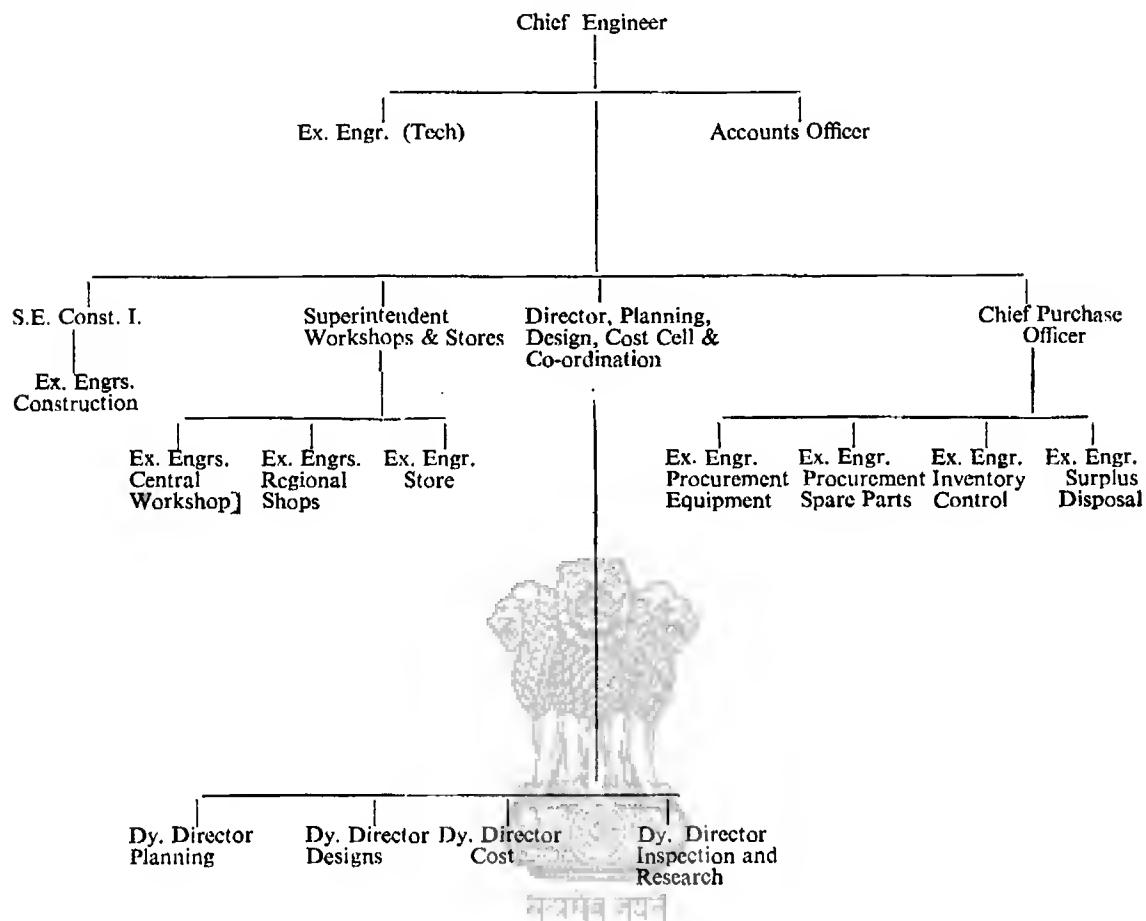
(1) Building of unnecessary workshops can be avoided. As pointed out above many of the small projects require service facilities only. Although such facilities must have a pukka floor, the balance of the buildings can be prefabricated by using steel trusses and columns with corrugated iron or ACC sheets for roofs and walls. When such a project is completed these structures could be dismantled and moved to the next site of work without sustaining any great material loss. For any given State the type of structures can be standardized. In addition, portable structures for other purposes can be fabricated.

(2) Standardization of Machines. With regard to standardization, after the complete census of machinery is taken for the State, the machines can be shifted in such a fashion that insofar as possible in any given type of machine, only one make or at the most, two makes need be located at any one work centre. This will simplify operation and maintenance to a very great extent as the personnel connected with this work will not be skilled on a large number of makes of machines, but only on the makes used where they are posted.

(3) Referring to the mobile field machinery units mentioned above, it is not the intention that these units be directly under the officer in charge of the Central Mechanical Organization. They would be allocated to the Engineer in charge of the particular work. Nevertheless it must be noted that when a Central-Mechanical Organization is established and functioning throughout the State, these units could also all be standardized in order that their parts and equipment could be interchangeable and that people trained to work with such a mobile unit in one location could be readily transferred and still be completely familiar with the unit and its equipment at a different location.



PROPOSED ORGANISATIONAL SET UP OF A CENTRAL MECHANICAL UNIT IN A STATE



INCOME TAX RULES ON DEPRECIATION

Table of rates at which depreciation is admissible

Class of asset	Depreciation allowance as % age of—
	(i) Actual cost in the case of ocean going ships;
	(ii) Written down value in the case of any other asset.
1. Mines and Quarries—Surface and underground machinery (other than electrical machinery, boilers and portable underground machinery), head-gear, moving parts and rails (N.E.S.A.)	15%
2. Machine tools (a) Automatic and Semi-Automatic] (b) Precision machine tools	15%
3. Road making plant and machinery	20%
4. Ropeway structure—Carriers	20%
5. Electrical machinery	20%
6. Earthmoving machinery employed in heavy construction works, such as dams, tunnels, canals, etc. (N.E.S.A.)	30%
7. Mines and quarries—Portable underground machinery and earthmoving machinery used in open cast mining (N.E.S.A.)	30%
8. Ropeway structures—Ropeways Ropes and trestle sheaves & connected parts (N.E.S.A.).	30%
9. Motors, Buses, lorries, taxies, tractors (N.E.S.A.)	30%

Extra shift depreciation allowance

An extra allowance upto a maximum of an amount equal to one half of the normal allowance shall be allowed where a concern claims such allowance on account of double shift working and establishes that it has worked double shift. An extra allowance upto a maximum of an amount equal to the normal allowance instead of one-half of the normal allowance, shall be allowed where a concern claims such allowance on account of triple shift working and establishes that it has worked triple shift.

The calculations of the extra allowance for double shift working and for triple shift working shall be made separately in the proportion to the number of days for which the concern worked double shift or triple shift, as the case may be, bears to the normal number of working days during the previous year. For this purpose, the normal number of working days during the previous year shall be deemed to be—

(a) in the case of a seasonal factory or concern, the number of days on which the factory or concern actually worked during the previous year or 180 days, whichever is greater;

(b) in any other case, the number of days on which the factory or concern actually worked during the previous year or 240 days, whichever is greater.

For example, where a non-seasonal concern worked 270 days during the previous year out of which it worked triple shift on 135 days and double shift on another 90 days, the extra depreciation allowance for triple shift working will be $135/270$, i.e., one-half of the normal allowance, and that for double shift working $90/270$, i.e., one-third of one-half of the normal allowance.

The extra shift allowance shall not be allowed in respect of any item of machinery or plant which has been specifically expected by inscription of the letters "N.E.S.A." (meaning 'No Extra Shift Allowance') against it.

SET OF PROFORMAE FOR RECORD KEEPING

1. OPERATOR'S LOG SHEET (Field Report)

Equipment Code No.

Date _____

Shift _____

Where used _____

No. of hours worked _____ No. of trips made _____

POL issued Diesel _____ Ltrs.

Lubricants _____ Ltrs.

_____ Ltrs.

_____ Ltrs.

Any defects noticed during operations:—

Operator

Idle Time _____ Breakdown Time _____

Reasons— _____

Reasons for low production: (Brief Note)

Repairs carried out during Breakdown Time:

Distribution of hours on different works if the machine
is used on more than one work and covered by differ-
ent estimates:—

Engineer-in-charge.

Foreman.

Recorded.

Record Clerk.

(Field Report)

2. DAILY FUELING REPORT

Date _____

Shift _____

Fueling Unit No. _____

Sl. No.	Equipment Code No.	Quantity in Ltrs.		Signature of Operator after entry in Log Sheet	Remarks
		H.S.D.	Petrol		
1	2	3	4	5	6

Recorded.

Record Clerk.

Incharge,

Fueling Unit.

3. DAILY LUBRICATION REPORT

Date _____

Lubrication Unit No. _____

Shift _____

S. No.	Equipment Code No.	Quantity in liters								Remarks
		Engine Oil	Air Cleaner Oil	Gear Oil	Hydrau- lic Oil	Brake Oil	Grease	Cardium Compound	Other Lubri- cants	
1	2	3	4	5	6	7	8	9	10	11

Recorded.

Record Clerk.

Incharge,
Lubrication Unit _____

Note:—If different grades of Lubricants are used the columns may be sub-divided to indicate the consumption of each grade separately.

4. DAILY SPARE PARTS CONSUMPTION REPORT (Field Report)

Date _____

Shift _____

Estimate No. _____

S. No.	Equipment Code No.	Details of spare parts issued	Cost
1	2	3	4



Recorded.

Record Clerk.

Incharge-Unit.
Engineer-in-charge.

5. DAILY ISSUES OF OTHER STOCK MATERIALS (Field Report)

Date _____

Shift _____

Estimate No. _____

S. No.	Equipment Code No.	Details of other stock materials issued	Cost	Remarks
1	2	3	4	5

Record Clerk.

Incharge Unit _____

Engineer-in-Chief _____

(Field Report)

6. DAILY REPORT ON PHYSICAL AVAILABILITY OF EQUIPMENT
(Equipment-wise)

Date _____

Shift _____

Unit _____

Sl. No.	Equipment Code No.	Total Avai- lable hours	Hours used on work	Hours kept as stand by	Repair maintenance hours	Major Re- pairs hours	Idle hours for		
							Want of work	Lack of matching equipment	Other Reasons
1	2	3	4	5	6	7	8	9	10



Recorded.

Record Clerk.

Unit In-charge.

Engineer-in-charge.

No. 7 DAILY LOG ABSTRACT

(Office Work)

Date.....

166

S. No.	Equipment Code No.	Total Hours Worked Shift			Expenditure on			Production achieved Shift				Remarks			
		1st		2nd	3rd	Fuel		Lubri- cants	Spares	Other Items	Total	1st	2nd	3rd	
						Fuel	Total				Total				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16



8. MONTHLY LOG ABSTRACT

Equipment Code. No. _____ Month _____

(Group of machines of same make and model in the Unit)

Date of Month	Hours worked	Production achieved	Consumption				Total
			P.O.L.	Spares	Other Stores		
1	2	3	4	5	6	7	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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24							
25							
26							
27							
28							
29							
30							
31							



Signature of Record Clerk.

MONTHLY AVAILABILITY & UTILISATION STATEMENT

Sl. No.	Equipment Code No.	Scheduled No. of hrs.	No. of hours actually available	No. of hours actually utilised	Percentage availability	Reasons for low availability	Percentage utilisation	Reasons for low utilisation	Remarks
1	2	3	4	5	6	7	8	9	10



Based on 25 working days, the following can be the standard schedule hours:—

Single shift — 175 hrs.

Double shift — 300 hrs.

Three shifts — 400 hrs.

11. EQUIPMENT RECORD REGISTER

(Office Work)

S. No.	Equipment Code No.	Make & Model of Equipment	H. P. & capacity	Purchase reference	Purchase price	Year of purchase	Source of purchase	Date of commission	Loca- tion	Age of the machine in terms of working hours at the end of the year				
										1st	2nd	3rd	4th	5th
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Engineer-in-charge.



12. FORM FOR ESTIMATION OF ANNUAL USE RATES OF EQUIPMENT

(Office Work)

S. No.	Cat- egory of equip- ment	Cost with tyres	Life	Ownership Maintenance Cost Operating Cost							Cost of tyres Total	Life of Tyres	Depre- ciation of tyres	Repair provi- sion of tyres	Over Head	Grand Total			
				Depre- ciation	Interest	Other mate- rials (*)	Repair labour	Supply	P.O.L.	Other Stores									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

N.B.— (*) Other materials should include cost of Wire Ropes, Batteries, Cutting Edges, Bucket Teeth etc.

LOAD FACTORS ON SPECIFIC JOB CONDITIONS

Diesel fuel consumption

0.5 lbs. per B.H.P. per Hour × load factor

Type of equipment Load factors on* specific job conditions

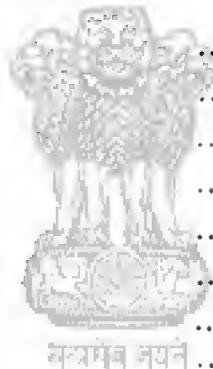
			Excellent	Average	Severe
Wheel type equipment (on road)	.	.	0.25	0.30	0.40
Wheel type equipment (off road)	.	.	0.50	0.55	0.60
Track type tractors	.	.	0.50	0.63	0.75
Excavators	.	.	0.50	0.55	0.60

Note:—*The job conditions Excellent, Average or Severe (or Light, Medium and Severe) can be seen from Appendix 8, 9.

CODIFIED NUMBERS FOR INVENTORY OF EQUIPMENT

Equipment Main Group Nos.

Excavators	..	A
Dumpers	..	B
Scrapers	..	C
Tractors	..	D
Graders	..	E
Loaders	..	F
Compactors	..	G
Water Tankers	..	H
Drills	..	I
Compressors	..	J
Crushers	..	K
Scalping, Screening and Feeding	..	L
Washing and Cooling	..	M
Batching and Mixing	..	N
Cleaning, Placing and Curing	..	O
Pumps	..	P
Lifting	..	Q
Grouting	..	R
Sheet Piling	..	S
Transport	..	T
Workshop Equipment	..	U
Power House Equipment	..	V



EQUIPMENT MAIN GROUP A--EXCAVATORS

Face Shovels	—	001	—	100
Draglines	—	101	—	200
Backhoes	—	201	—	300
Clamshells	—	301	—	400
Bucket wheels	—	401	—	500
Dredgers	—	501	—	600
Walking Draglines	—	601	—	700

MAIN GROUP B—DUMPERS

Rear Dumpers	—	001	—	100
Bottom Dumpers	—	101	—	200
Shuttle Dumpers	—	201	—	300
Tunnel Dumpers	—	301	—	400
Side Dumpers	—	401	—	500

MAIN GROUP C—SCRAPERS

Motorised Scrapers	—	001	—	100
Elevating Scrapers	—	101	—	200
Twin Engined	—	201	—	300
Towed Scrapers	—	301	—	400

MAIN GROUP D—TRACTORS

Crawler	—	001	—	200
Wheeled	—	201	—	400

MAIN GROUP E—GRADERS

Wheeled	—	001	—	100
Towed	—	101	—	200
Elevating	—	201	—	300

MAIN GROUP F—LOADERS

Crawler	—	001	—	100
Wheeled	—	101	—	200
Muckers	—	201	—	300
Belt Loaders	—	301	—	400
Reclaimers	—	401	—	500
Belt Conveyors	—	601	—	700
Elevators	—	701	—	750

MAIN GROUP G—COMPACTORS

Self Propelled sheepfoot roller	—	001	—	050
Self Propelled Vibratory rollers	—	051	—	100
Drawn Sheepfoot rollers	—	101	—	200
Drawn Vibrators rollers	—	201	—	250
Pneumatic tyred rollers	—	251	—	300
Smooth Drum Vibratory rollers	—	301	—	350
Wheeled Grid rollers	—	351	—	400
Smooth Drum rollers	—	401	—	500
Pneumatic tampers	—	501	—	600

MAIN GROUP H—WATER TANKERS\$

Highway truck tankers	—	001	—	100
Dumper tankers	—	101	—	200
Conventional off-highway Sprinklers	—	201	—	300
Towed tankers	—	301	—	400

MAIN GROUP I—DRILLS

Auger Drills	—	001	—	100
Core Drills	—	101	—	150
Rotary or Blast hole Drills	—	151	—	200
Percussion Drills	—	201	—	400
Shot Drills	—	401	—	450
Churn Drills	—	451	—	500
Tricon Rotary Drills	—	501	—	550
Drilling Jumbos	—	550	—	600
Hydro Booms	—	601	—	650
Pneumatic leg Pushers	—	651	—	700

MAIN GROUP J—COMPRESSORS—

Portable diesel Compressors upto 300 c.f.m.	—	001	—	100
Portable Electric Compressors upto 300 c.f.m.	—	101	—	200
Portable Diesel Compressors above 300 c.f.m.	—	201	—	300
Portable Electric Compressors above 300 c.f.m.	—	301	—	400
Compressors Stationary Diesel upto 1000 c.f.m.	—	401	—	500
Compressors Stationary electric upto 1000 c.f.m.	—	501	—	600
Compressors Stationary Diesel above 1000 c.f.m.	—	601	—	700
Compressors Stationary Electric above 1000 c.f.m.	—	701	—	800
Blowers	—	801	—	900

MAIN GROUP K—CRUSHERS

Portable Crushing Plant	—	001	—	100
Jaw Crushers	—	101	—	200
Cyratory Crushers	—	201	—	300
Hammer Mills	—	301	—	400
Cone Crusher	—	401	—	500
Roll Crushers	—	501	—	600
Rod Crushers	—	601	—	700
Rod Mills	—	701	—	800
Ball Mills	—	801	—	900

MAIN GROUP L—SCALPING, SCREENING AND FEEDING PLANT

Revolving Screens	—	001	—	100
Vibratory Screens	—	101	—	200
Grizzling	—	201	—	300
Feeders	—	301	—	400

MAIN GROUP M—WASHING AND COOLING

Portable log Washers	—	001	—	100
Fine material Washers	—	101	—	200
Coarse material Washers	—	201	—	300
Aggregate Cooling Plant	—	301	—	400
Ice Plant	—	401	—	500

MAIN GROUP N—BATCHING AND MIXING

Cement handling Plants	—	001	—	100
Batching & Mixing Plants	—	101	—	200
Portable Batching and Mixing Plants	—	201	—	300
Weigh Batchers	—	301	—	400
Concrete Mixers	—	401	—	500
Paver Mixers	—	501	—	600
Transit Mixers	—	601	—	700
Agitating Cars	—	701	—	800

MAIN GROUP O—CLEANING, PLACING AND CURING

Pump Cretes	—	001	—	100
Concrete Buckets	—	101	—	200
Pneumatic Concrete Placers	—	201	—	300
Vibrators	—	301	—	400
Sand Blasting Equipment	—	401	—	450
Concrete Pavers	—	451	—	500
Pavement Breakers	—	501	—	550
Mechanical Booms	—	551	—	600
Concrete Saws	—	601	—	650

MAIN GROUP P—PUMPS

Dewatering Pumps	—	001	—	100
Lift Pumps	—	101	—	200
Sludge Pumps	—	201	—	300
Well Points	—	301	—	400
Sand Pumps	—	401	—	500
Chemical Pumps	—	501	—	600
Vaccum Pumps	—	601	—	700

MAIN GROUP Q—LIFTING

Cranes --Crawler	—	001	—	100
--Truck Mounted	—	101	—	150
--Mobile	—	151	—	200
--Tower	—	201	—	250
--Gantry	—	251	—	300
--Trestle	—	301	—	350
--O.H.	—	351	—	400
--Tractor	—	401	—	450
Winches and Hoists	—	451	—	500
Fork Lifts	—	501	—	600

MAIN GROUP R—GROUTING

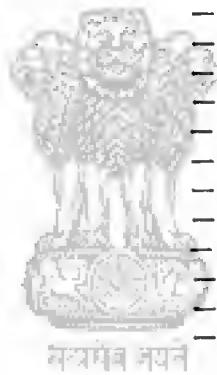
Cement Grouting machines	—	001	—	100
Grout Pumps	—	101	—	200
Wagon Grouts	—	201	—	300
Air Motors	—	301	—	400

MAIN GROUP S—SHEET PILING

Pile Drivers	—	001	—	100
Pile Hammers	—	101	—	200
	—	201	—	300
	—	301	—	400

MAIN GROUP T—TRANSPORT

Heavy Transport Vehicles	—	TH	—	
Truck Tractor Trailers	—	001	—	100
Semi Trailers	—	101	—	200
Low Bed Trailers	—	201	—	300
Prime Movers	—	301	—	400
Light Transport Vehicles	—	TL	—	
Jeeps	—	001	—	100
Station Wagons	—	101	—	200
Cars	—	201	—	300
Trucks	—	301	—	400
Trailers	—	401	—	500
Busses	—	501	—	600
Ambulance Cars	—	601	—	700
Water Transport	—	TW	—	
Barges	—	001	—	100
Tugs	—	101	—	200
Steamers	—	201	—	300
Launches	—	301	—	400
Boats	—	401	—	500
Aerial Transport	—	TA	—	
Rope Ways	—	001	—	100
Cable Ways	—	101	—	200
Rail Transport	—	TR	—	
Locomotives	—	001	—	100
Wagons	—	101	—	200
Rail Cars	—	201	—	300



MAIN GROUP U—WORKSHOP EQUIPMENT

Machine Repair Shop Equipment	—	001	—	100
Machine Shop Equipment	—	101	—	200
Fabrication Shop Equipment	—	201	—	300
Maintenance & Servicing Equipment	—	301	—	400
Electric repair shop Equipment	—	401	—	500
Misc. Shop Equipment	—	501	—	600
Tyre Retreading Equipment	—	601	—	700

MAIN GROUP V—POWER HOUSE EQUIPMENT

Diesel Engines	—	001	—	100
Boilers	—	101	—	200
Turbines	—	201	—	300
Generators	—	301	—	400
Electrical Accessories	—	401	—	500

Note:—If a Project has Bottom Dumper of various sizes the numbers between 101 to 200 set forth for Bottom Dumper under Main Group B—‘Dumper’ can be suitably distributed according to the sizes and makes and Project serial number will be given to the Dumper accordingly. If a Dumper has been given Sl. No. 120 it can be identified as B—120 (B standing for the Main Group ‘Dumper’).

The same codified numbers shall not be given to more than one machine even if a new machine substitutes an earlier machine which has been put out of circulation or disposed of.

APPENDIX 13.5

P.W.A. FORM No. 16 REGISTER OF MANUFACTURE (A typical extract from Beas Project Accounts)

NAME OF MANUFACTURE :— W/O D-8 CATTER PILLER TRACTOR DOZER IN BEAS DAM DURING 1969-70 CODE No. 712-606.

AUTHORITY :— SUPERINTENDING ENGINEER ADMN. & STORES No. 1077-78/166-W, dated 10-3-1969 FOR THE YEAR Rs. 15677598/- FOLIO No.

	OPERATION						TOTAL OPERATION			OUTTURN			
	Direct Labour Amount	Fuelling Services	Lubrica- tion Services	Fuel and Lubrica- tion Supplies	Miscs Supplies	Shop Charges	Spare Part	Depre- ciation	Major over- hauling	Working hours	Amount	Balance at debit of Manu- facture	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
ESTIMATE PROVISION (In Rs.)	6,46,074	54,120	1,42,065	45,40,866	2,54,073	6,02,550	14,05,575	26,77,425	53,54,850	1,56,77,598			
D-8 Old @	.	6.08	0.40	1.05	19.72	1.41	2.25	5.25	10.00	20.60	37800 hrs. @ Rs. 66.16=		
D-8 235 HP @	.	4.30	0.40	1.05	34.92	1.89	3.50	8.15	15.53	31.06	22500 hrs. @ Rs. 100.80=		
D-8 270 HP @	.	4.26	0.40	1.05	40.13	2.11	5.85	13.65	26.00	52.00	75000 hrs. @ 145.45 =		
											Rs. 2268000		
											Rs. 2500848		

Appendix 13.5—*contd.*

(Rupees in lakhs)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
April, 1969	0.11	.	.	0.12	..
May, 1969	.	.	0.24	..	..	1.18	..	0.06	0.18	..	..	1.65	0.04	4.80
Total	.	.	0.24	..	..	1.18	..	0.36	0.29	..	..	1.77	0.04	4.80
June, 1969	.	.	0.26	..	..	1.88	..	0.09	0.23	..	..	2.46	0.06	7.19
Total	.	.	0.50	..	..	3.06	..	0.15	0.52	..	..	4.23	0.10	11.99
July 1969	.	.	0.23	..	..	2.53	..	0.10	0.28	2.93	5.87	11.94	0.04	4.83
Total	.	.	0.73	..	..	5.59	..	0.25	0.81	2.93	5.87	16.18	0.14	16.82
August 1969	.	.	0.22	..	..	..	..	0.13	0.33	..	..	0.69	0.05	5.99
Total	.	.	0.95	..	..	5.59	..	0.38	1.14	2.93	5.87	16.86	0.19	22.81
Sept. 1969	.	.	0.18	0.07	0.18	1.28	0.01	0.60	0.29	..	..	2.62	0.05	6.46
Total	.	.	1.13	0.07	0.18	6.87	0.01	0.98	1.43	2.93	5.87	19.48	0.23	29.27
Oct. 1969	.	.	0.11	..	..	0.92	..	0.47	0.19	0.21	0.43	2.35	0.05	7.14
Total	.	.	1.24	0.07	0.18	7.79	0.02	1.45	1.63	3.15	6.30	21.82	0.29	36.41
Nov. 1969	.	.	0.23	0.04	0.11	1.32	..	0.11	0.32	1.30	2.62	6.06	0.05	7.88
Total	.	.	1.47	0.11	0.30	9.11	1.56	0.02	1.95	4.46	8.92	27.89	0.34	44.29
Dec. 1969	.	.	0.25	..	..	..	..	0.42	0.13	..	..	0.80	0.06	8.39
Total	.	.	1.72	0.11	0.30	9.11	0.02	1.98	2.08	4.46	8.92	28.69	0.41	52.69
Jan. 1970	.	.	0.20	..	..	3.68	..	0.58	0.29	..	..	4.75	0.08	10.80
Total	.	.	1.92	0.11	0.30	12.79	0.02	2.56	2.37	4.46	8.92	33.44	0.49	63.48
Feb. 1970	.	.	0.22	0.08	0.20	5.30	0.01	0.32	0.09	2.96	5.93	15.10	0.09	12.06
Total	.	.	2.14	0.19	0.50	18.09	0.03	2.88	2.45	7.42	14.84	48.54	0.58	75.54
March 1970	.	.	0.23	..	..	2.43	..	0.58	0.24	2.94	5.89	12.32	0.07	9.02
Total	.	.	2.37	0.19	0.50	21.53	0.03	3.47	2.70	10.36	20.73	60.86	0.66	84.56

TYPICAL ANNUAL ESTIMATES FOR OWNERSHIP AND OPERATING COST IN RESPECT OF (i) BOTTOM DUMPERS, (ii) EXCAVATORS, ELECTRIC—7 Cyds., BASED ON 'DECLINING BALANCE METHOD OF DEPRECIATION'— PREPARED BY BEAS PROJECT

(i) Numbers of machines	36
(ii) Capital cost of each machine without tyres	5,00,000
(iii) Residual value of machine at the beginning of the year	Rs. 2,50,000
(iv) Cost of tyres	Rs. 1,00,000
(v) Life of tyres	2500 hours
(vi) Total No. of hours already clocked by the machines	10,000
(vii) Anticipated working hours during the year per machine in 3 shifts operation	= 10 months × 25 days × 14 hours = 3500 hours

1. *Owning Cost.*

$$\begin{aligned} \text{Depreciation by declining balance method @ 30\% from appendix } \\ 8.4 \text{ item 2(ii)} &= 2,50,000 \times 30 \\ &\quad \underline{100} \\ &= \text{Rs. 75,000} \end{aligned}$$

$$\begin{aligned} \text{Hourly depreciation} &= \frac{7500}{3500} = \frac{150}{7} \\ &= \text{Rs. 21.40} \end{aligned}$$

2. *Operating Cost.*

(a) *Repair Charges.*

$$\begin{aligned} \text{Allowable amount of repairs as \% of capital cost from appendix 8.7} \\ \text{Amount} &= 5,00,000 \times 35 \\ &\quad \underline{100} \\ &= 77.5 - 42.5 \\ &= 35\% \\ &= \text{Rs. 1,75,000} \end{aligned}$$

$$\begin{aligned} \text{Hourly rate} &= \frac{1,75,000}{3500} \\ &= \text{Rs. 50 per hour} \end{aligned}$$

(b) *Tyre Costs.*

$$\begin{aligned} \text{Hourly Cost} &= \frac{1,00,000}{3500} \\ &= \text{Rs. 40 per hours} \end{aligned}$$

(c) *Operating Labour Charges.*

$$4 \text{ Operators/Mechanics/Machine @ 450/- P.M.} = 4 \times 450 = \text{Rs. 1800}$$

$$\begin{aligned} \text{Hourly rate} &= \frac{1800}{25 \text{ days} \times 14} \\ &= \text{Rs. 5.10} \end{aligned}$$

(d) *Fuels and Lubricants/Hour.*

Fuel — 25 litre H.S. Diesel oil @Rs. 1.00/lit.	Rs. 25.00
1.0 litre engine oil @2.40/lit.	Rs. 2.40
1.0 litre transmission oil @2.0/lit.	Rs. 2.00
0.6 litre gear oil @2.0/lit.	Rs. 1.20
0.2 Kg. grease @4.00/Kg.	Rs. 0.80
0.8 litre Hyd. oil @2.0/lit	Rs. 1.60
Total	Rs. 33.00

(e) *Filters.*

(i) 1 No. Primary fuel @ 40	Rs. 40.00
2 No. secondary fuel filter @ 40 each	Rs. 80.00
Total	Rs. 120.00

Filters are to be changed every 240 hrs.

$$\text{Therefore, rate/hr.} = \frac{120}{240} = \text{Rs. } 0.5$$

- (ii) 3 No. lubricating oil filter @ 50 each for 125 hrs. = Rate = $3 \times 50 - 125 = \text{Rs. } 1.20$.
- (iii) Transmission oil filter @ 40 each to be changed after 240 hrs. = Rate $\times 40 - 240 = \text{Rs. } 0.16$.
- (iv) 2 Nos. Hydraulic oil filter @ 50 each change after 500 hrs. = Rate = $100 - 500 = 0.20$.

(v) 4 Air filters @ 250 each = 1000
change after 1000 hrs.
Hourly rate = Rs. 1.00

(vi) Petty items like grease nipples etc. L.S./hr. = Rs. 0.25

(vii) Lubrication service & fuelling/hr. = Rs. 2.00

Total = Rs. 33.00
+ 0.50
1.20
0.16
0.20
1.00
0.25
2.00
<hr/>
38.31



Say Rs. 38.30/hour.

(f) *Misc. Supply.*

like wire ropes, head lamps, battery and battery service etc.—L.S./hr. = 5.00

3. *Total Owning and Operating Rate/hour*

	Rs.
Depreciation	21.40
Repairs	50.00
Tyres Costs	40.00
Labour	5.10
Fuel & Lubricants	38.30
Misc. Supply & Small Tools	5.00
<hr/>	
Grand Total	<u>159.80</u>

Say = Rs. 160.00 hour.

Note : Against item 'c', page 2 preceding, cost of Idle labour for '2' months would be $1800 \times 2 = \text{Rs. } 3600$. Distributing this over 3500 Hrs. of annual operation Re. 1/- per hour, has to be added to the total of Rs. 160.00 per hour.

ANNUAL ESTIMATE FOR AN ELECTRIC EXCAVATOR 7 CYDS. (VALUES ARE ASSUMED TO ILLUSTRATE THE METHOD OF WORKING OUT RATE)

1. Ownership Cost.

Depreciation.

Assume capital Cost	Rs. 45,00,000.
Depreciation already earned by the machine by straight line method or declining balance method	Rs. 25,00,000
The residual price at the beginning of the year = Capital Cost minus depreciation already earned	= 45,00,000 - 25,00,000 = Rs. 20,00,000
Depreciation by declining balance method @15% on three — shift basis from appendix 8.4 (Item 1)	= 20,00,000 × $\frac{15}{100}$ Rs. 3,00,000
Expected operation hours during the year	4,000
Hourly rate of depreciation	3,00,000 ÷ 4000 = 75/-

Note:—Full amount of Rs. 3,00,000 will be credited to V/S L & P and debited to works irrespective of the number of hours actually clocked during the year.

2. Operating Cost.

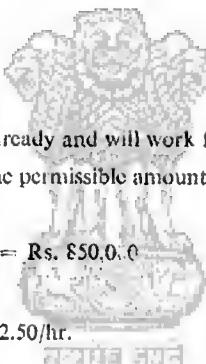
(a) *Repair Charges.*

The machine has clocked 21,000 hrs. already and will work for 4000 hrs in the next year.

At the stage of 21,000 to 24,000 hrs, the permissible amount of repairs are (58%—40%) = 18% from appendix 8.7 — (item 14).

$$\text{Amount of repairs} = 45,00,000 \times \frac{18}{100} = \text{Rs. } 850,000$$

$$\text{Hourly rate} = 8,50,000 \div 4000 = 2,12.50/\text{hr.}$$



(b) *Direct Labour.*

(i) 3 Operators @ Rs. 600 p.m. = 1800 × 12	• • • = 21,600
3 Greasers @ Rs. 150 p.m. = 3 × 150 × 12	• • • = 5,400
9 Cable men @ 150 p.m. = 9 × 150 × 12	• • • = 16,200
3 No. Bossman @ 300 p.m. = 3 × 300 × 12	• • • = 10,800

(ii) *Maintenance Crew*

3 No. Electricians @ Rs. 300 p.m. = 3 × 300 × 12	• • • = 10,800
3 No. Mechanics @ 300 p.m. = 3 × 300 × 12	• • • = 10,800
	Total • 75,600
Add leave reserve at $\frac{1}{4}$	• 18,900

$$\text{Hourly rate} = 94,500 = \text{Rs. } 23.60/\text{hr.}$$

—————
4000

(c) *Fuels and Lubricants.*

350 Kg. Viscolite grease No. 2 @ 4.25/Kg.	• • • = 1,488.00
120 Kg. M.P. grease @ 4/Kg.	• • • = 480.00
300 Kg. grease No. 2 @ 4.30/Kg.	• • • = 1,290.00
420 Kg. grease packing @ 4.20/Kg.	• • • = 1,764.00

60 Kg. B.R.B. grease No. 1 @4.10/Kg.	•	•	•	•	= 246.00
120 Kg. viscolite grease No. 1 @ 4.25/Kg.	•	•	•	•	= 510.00
200 Lts. Talus oil No. 27 @2.05/l.t.	•	•	•	•	= 410.00
240 Lts. Talus oil No. 27 @2.05/l.t.	•	•	•	•	= 492.00
400 Lts. Mobile oil @2.05/l.t.	•	•	•	•	= 615.00
120 Lts. Victored No. 33 @2.05/l.t.	•	•	•	•	= 246.00
					<hr/> = 7,541.00
Hourly rate = 7,541.00 ÷ 4000	•	•	•	•	= 1.88/hr. } 3.56
Lubrication service	•	•	•	•	= 1.68/hr. }
(d) Miscellaneous supply and small tools	•	•	•	•	= L.S. = Rs. 10/- hr.
(e) Electric energy = 150 units @ .16	•	•	•	•	= Rs. 24.00

3. Total hourly Rate.

Depreciation	•	•	•	•	•	•	•	= 75.00
Repairs	•	•	•	•	•	•	•	= 212.50
Labour	•	•	•	•	•	•	•	= 23.60
Fuel & Lub.	•	•	•	•	•	•	•	= 3.56
Misc. Supplies	•	•	•	•	•	•	•	= 10.00
Elect. Energy	•	•	•	•	•	•	•	= 24.00
							Total	<hr/> = 328.66/hour.

**MONTHLY COST ABSTRACT**

Equipment Code No./Work Account Code No.

Breakup of hours
employed on different works

Month_____

Total Nos. available_____

Available machine hours_____

Works A/cs Code No. hrs.

1

Estimated Operation hours._____

2

Actual machine hours._____

3

Operated during the month_____

4

Total repair hours_____

Machine-wise

1 2 3 4 5 6 7

Operational Supplies

Fuel/Power.

Lubricants.

Wire Ropes.

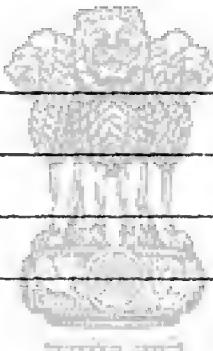
Cutting Edges.

Filters.

Other Misc. Supplies.

Total

	Machine-wise						
	1	2	3	4	5	6	7
Spare Parts.							
Tyres.							
Total							
<i>Labour.</i>							
Operation & Maintenance.							
Rcpairs.							
Workshop.							
Stores.							
Total							
<i>Overheads.</i>							
Workshop Charges.							
Energy Charges.							
Stores Charges.							
Other Charges.							
Total							
Depreciation							
Grand Total							



Standard hourly rate as estimated.

Actual hourly rate as calculated from the month.

Cumulative hourly rate upto the month for the year.

Cumulative rate upto the year beginning.

Remarks for variation.

**RECORD OF INFORMATION ON SPARE PARTS FOR ANNUAL
ACCOUNTING**

Equipment Code No. —————

Nos. off.—

Estimated Provision in cost Estimate Rs _____

Make & Model of machine—

For the period from _____ to _____

Financial years					
1st 1972-73	2nd 1973-74	3rd 1974-75	4th 1975-76	5th 1976-77	6th 1977-78

I. Annual provision and consumption.

- (a) Scaled provision for the year
- (b) Balance carried forward ±
- (c) Net amount available for the year
- (d) Consumption during the year
- (e) Balance at year end ±

Financial years

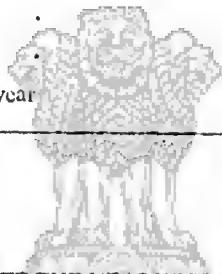
	1st 1972-73	2nd 1973-74	3rd 1974-75	4th 1975-76	5th 1976-77	6th 1977-78
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II. Provision and expenditure on purchases.

- (a) Balance at year beginning
- (b) Less liabilities (amount of outstanding) to end of last year
- (c) Net provision available at the beginning of year
- (d) Value of Purchase Orders placed during the year
- (e) Payments made during the year
- (f) Pending liabilities at year end
- (g) Balance provision available at year end

III. Value of Stores.

- (a) Value of balance in stock at year beginning
- (b) Value of receipts during the year
- (c) Value of issues during the year
- (d) Value of items written off or disposed of
- (e) Value of balance in stock at the end of the year



APPENDIX 13·9

TABLE WORKED OUT TO INDICATE THE YEARWISE INVESTMENT COST, DEPRECIATION, RESIDUAL VALUE, AVERAGE INVESTMENT AND INTEREST CHARGES AT 20% DECLINING BALANCE DEPRECIATION RATE AND 10% INTEREST RATE

Year	Investment at the beginning of the year	Depreciation for the year at 20% rate	Total depreciation upto the year	Residual value at the end of the year	Average annual investment Col. 4	Annual interest charges at 10% rate
					Col. 1 × rate of depreciation	
1	2	3	4	5	6	7

TABLE I

1	100	20	20	80	100	10
2	80	16	36	64	90	9
3	64	12·8	48·8	51·2	81·4	8·14
4	51·2	10·24	59·04	40·96	73·8	7·38
5	40·96	8·192	67·232	32·768	67·23	6·723
6	32·768	6·5536	73·7856	26·2144	60·5	6·05
7	26·214	5·2428	78·9284	20·9714	56·38	5·638
8	20·971	4·1943	83·1227	16·7772	51·95	5·195
9	16·777	3·3554	86·4781	13·4216	48·04	4·804
10	13.421	2.6843	89.1624	10.7374	44.58	

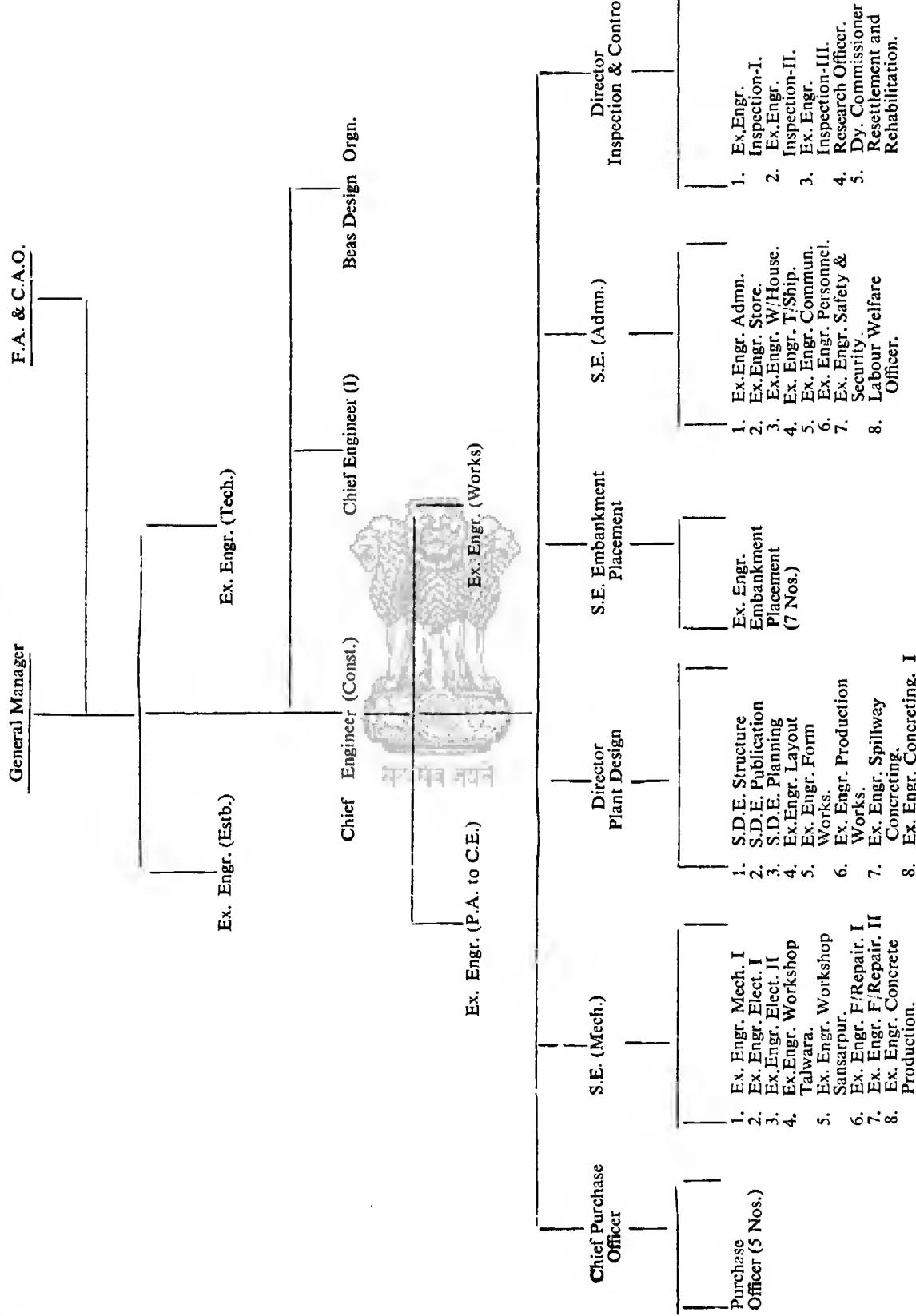
1	2	3	4	5	6	7
TABLE II (Rounded off)						
1	100	20	20	80	100	
2	80	16	36	64	90	
3	64	13	49	51	81	
4	51	10	59	41	74	7.4
5	41	8	67	33	67	6.7
6	33	7	74	26	61	6.1
7	26	5	79	21	56	5.6
8	21	4	83	17	52	5.2
9	17	4	87	13	48	4.8
10	13	3	90	10	45	4.5



I. BEAS PROJECT

APPENDIX 14.1

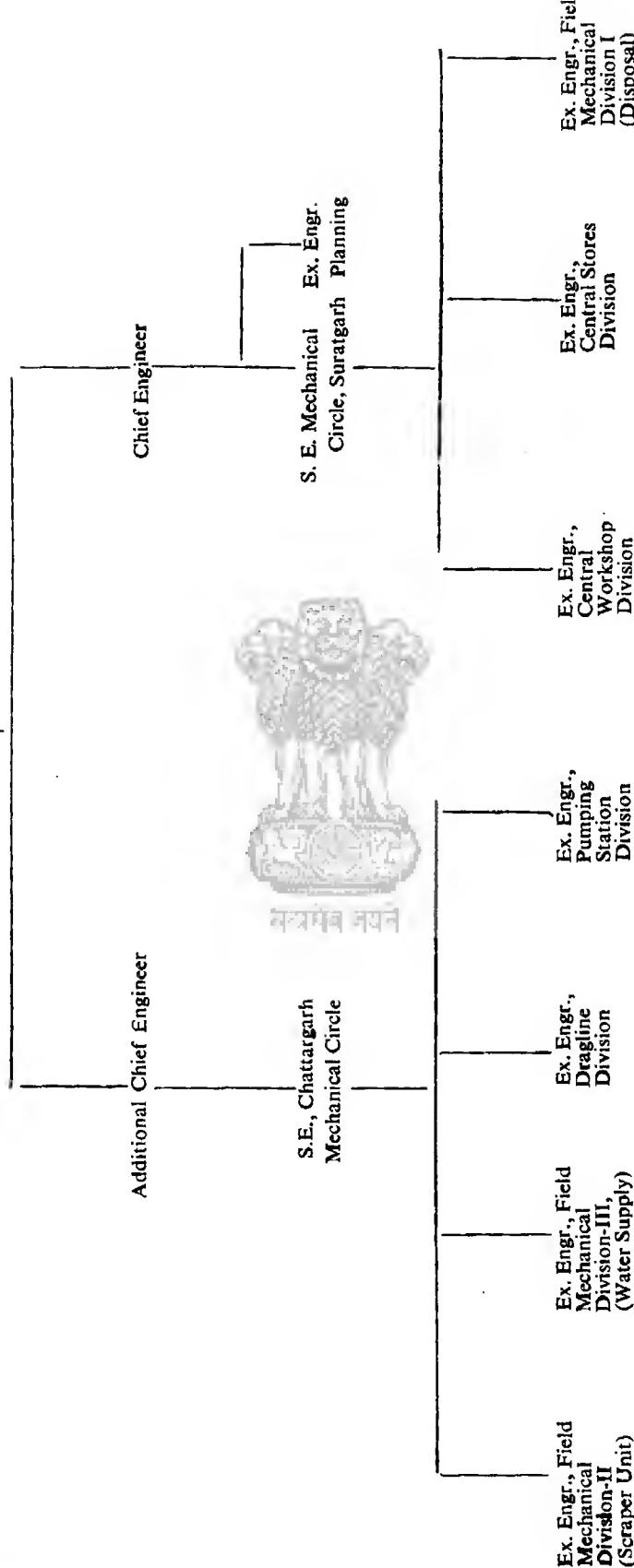
ORGANISATIONAL SET UP WITH SOME MAJOR USERS OF EQUIPMENT



II. RAJASTHAN CANAL PROJECT

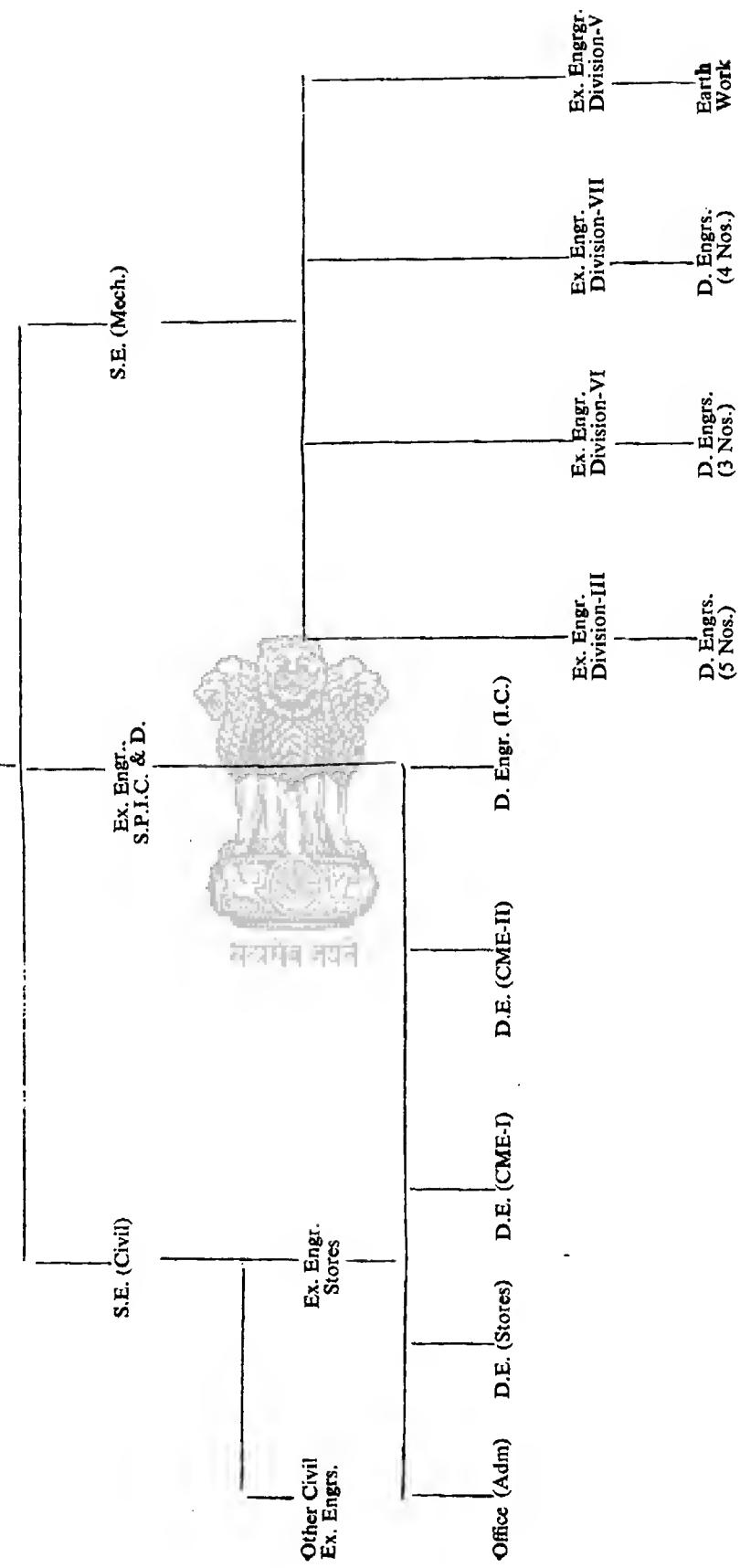
Rajasthan Canal Board

25—4 CW&PC/ND/75



III UKAI PROJECT

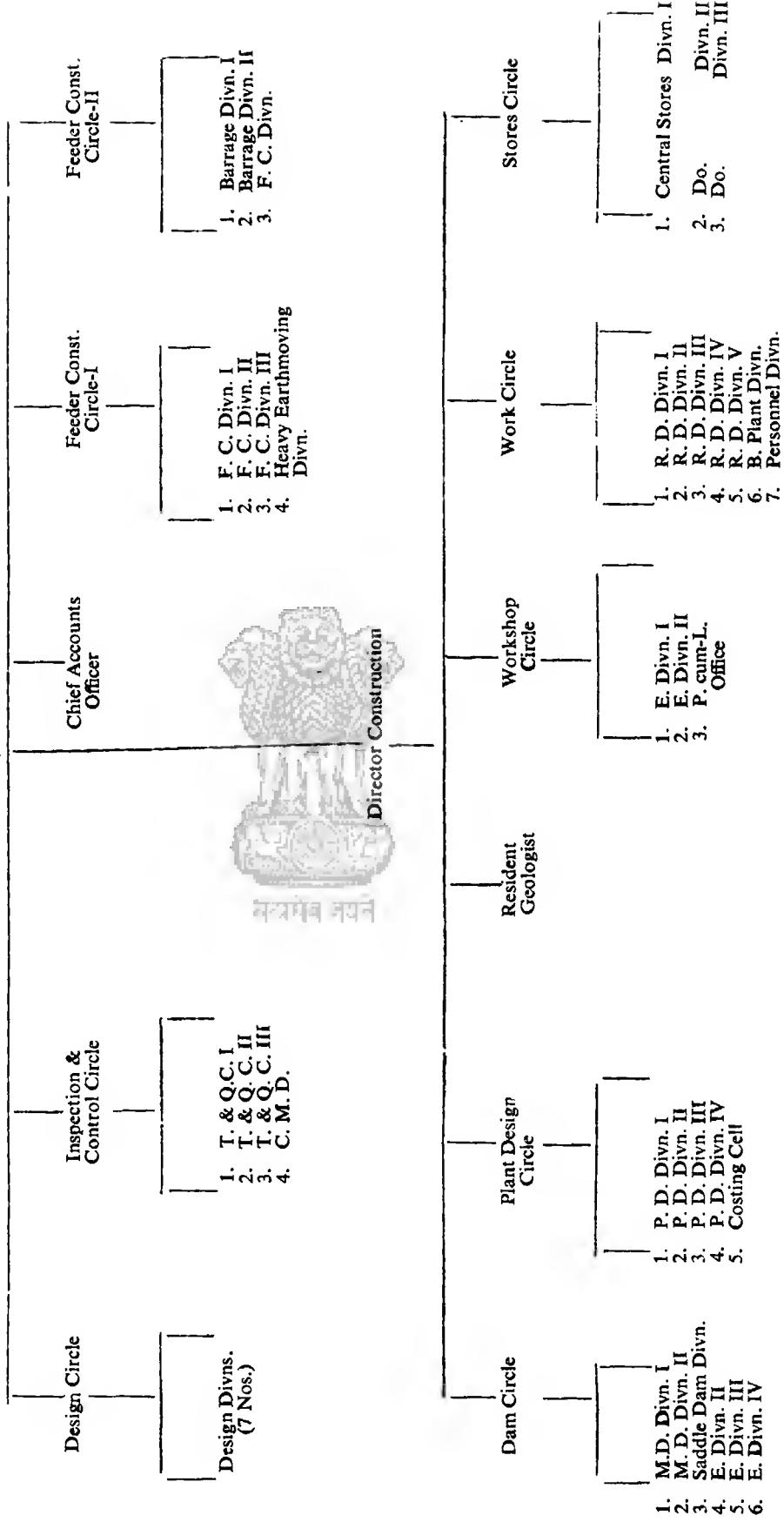
Chief Engineer



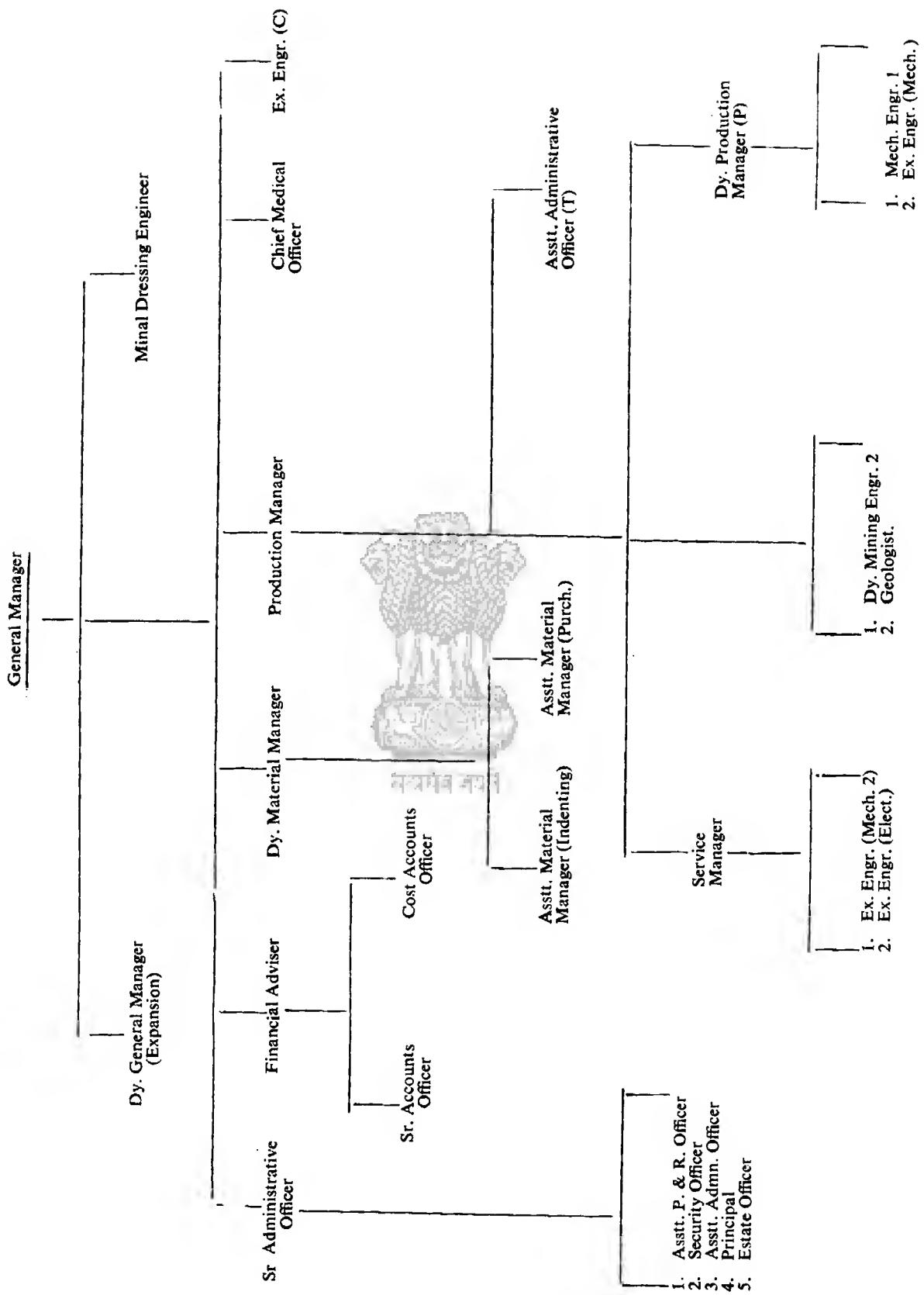
IV. RAMGANGA PROJECT

Chief Project Engr.

F.A. & C.A.O.

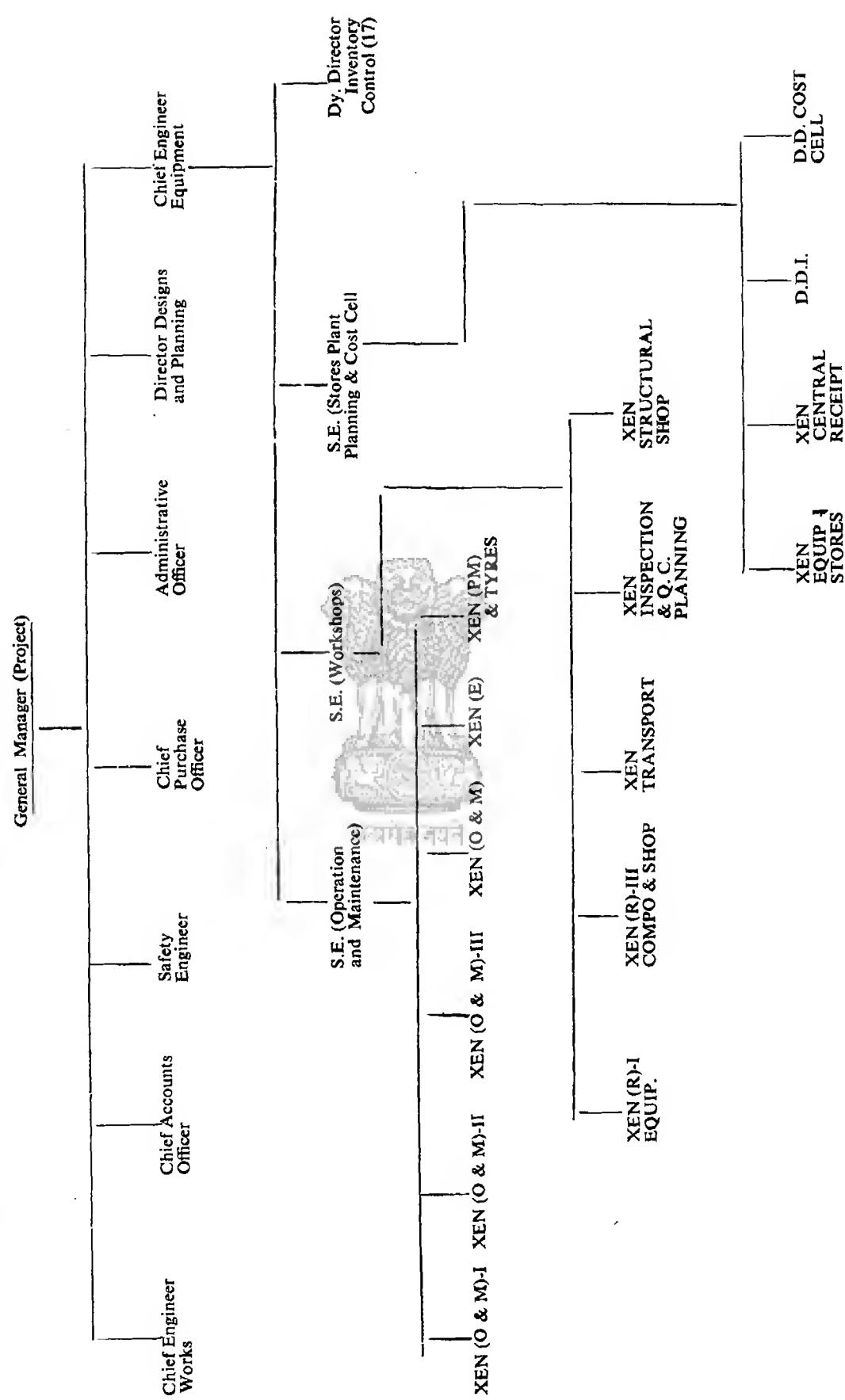


V. M. N. D. C. (KIRIBURU MINES)



APPENDIX 14.2

PROPOSED ORGANISATION FOR PROJECTS USING EQUIPMENT WORTH RS. 100 TO 150 MILLION AT ONE LOCATION



INCENTIVE BONUS SCHEMES IN IRRIGATION AND POWER PROJECTS

A. 'Beas Project'

1. It is felt that the tempo of the tunneling work can be considerably increased with Bonus Scheme, inspite of all efforts it becomes difficult to economically tie operations of one shift with others as the workmen look from the point of view of work and progress in their shift and not of other shifts. For example, if the main job for one shift is drilling, the workmen have a tendency to complete just that work, though they could, with little more effort do other work also, leading to early completion of the over-all cycle, of operation. Introduction of bonus scheme would remove this tendency and all the three shifts would try to work as a team.

2. Basis on which the Bonus should be fixed has been under consideration of the senior officers for some time and it is felt that a logical and fair proposition could be to award the saving in direct labour charges accruing from increased progress amongst the officers/staff/workmen employed. Truely speaking, the labour cost as actually obtained should be taken for calculation of bonus but as the estimated cost is the lower the same would be assumed. Indirect benefit of finishing the job earlier, giving earlier return and decreasing the over head would be in addition.

3. The work and the part played by each workman is different and while workmen in some of the categories would be more instrumental in getting increased progress other would be less. Bonus points thus to be fixed for each category depending on the efforts required towards greater progress and the work involved. Proposed points are shown category-wise in the attached statements.

4.* To make the bonus scheme effective and successful it is necessary that officers including upto the rank of General Manager, must be made a party to it. While the bonus points for workmen are shown in the attached statements, those suggested for categories of Sectional Officers and above are given below:—

(a) Sectional Officers, Civil, Mech. Electrical	= 7 points each.
(b) S.D.Os. Civil, Mech. Electrical	= 9 points each.
(c) Xens. Civil, Mech. Electrical For an Xen. Electrical or Mechanical who is incharge of more than one main heading bonus points would reduce to 7.	=10 points each.
(d) S. Es. Civil & Mechanical	=10 points (To be reduced to 7 if 2 main headings fall in his charge).
(e) General Manager & Chief Engineer (They have less points because they could have 2-3 headings eligible for bonus).	= 4 points.

Total number of points for which bonus would be required to be distributed would vary from Division to Division but are expected to be in the neighbourhood of 1600. Saving to the Government with increased progress with the same labour and staff on excavation on direct labour and electric charges would be as follows:—

In the estimate of excavation from R.D. 21000 to 39952 direct Labour =Rs. 7.58 per cyd.
cost provided is.

Electric Energy charges excluding those of welding sets which would be saved with increased progress	=Rs. 1.31	Do.
TOTAL	=Rs. 8.89	

or Say ; Rs. 9/- per cyd. or Rs. 31.28 (cyd.) \times 9=Rs. 281.52 per ft. of the tunnel.

As the work of initial concreting goes on simultaneously with the excavation, increased progress on excavation would also mean increased in progress on initial concreting. On an average there is 9 cyd. of initial concreting per foot run of the tunnel and with direct labour rate of 18.70 per cyd. there would be saving of Rs. 56.10 per foot. Thus total saving would be Rs. 281.52= $+58.10=337.62$.

5. Past figures have shown that the progress on Sundarnagar Sutlej Tunnel where finished diameter is 28 feet and quantity of excavation 31.28 cyd. per foot length crosses the progress of 300 feet per month at the main heading with considerable efforts. Progress of 340 feet has been achieved only in December at one of the headings where work has been in progress for the last 20 months. On the Pendoh Baggi tunnel where finished diameter is 25 feet and quantity of excavation 26.13 cyd. per foot, the maximum figure once touched was 408 feet but the average for the last 12 months from 1/68 to 12/68 from Baggi and has been 224 feet and from Pendoh end 232 feet. Low figure is due to bad strata encountered every now and then. The same cannot be ruled out for future also.

Based on the past experience normal progress of Sundarnagar Sutlej tunnel is recommended as 300 ft. Presuming that the Bonus incentive would give a progress of 350 feet, the bonus earned would be as follows:—

(a) For excavation 50 feet \times 31.28 cyd. \times Rs. 9.00	=14,076.00
(b) For concreting 3 cyd. \times 50 feet \times 18.17	=2,725.50
<hr/>	
	=16,801.50

Bonus per foot increased progress

16801.50	=Say;
50	336.03

Bonus value for 50 feet increased progress on Sundarnagar Sutlej tunnel would thus be Rs. 16801.50 = Say Rs. 10/- per point
 $\frac{16801.50}{1600}$

Foreman excavation would thus get $5 \times 10 =$ Rs. 50/- Xen 10 $\times 10 =$ Rs. 100/-. This is reasonable to tempt them to put in harder work and at the same time not out of proportion to their normal wages.

Calculating on the same basis, for Pandoh-Baggi tunnel, bonus per foot of increased progress would be as follows:

- (i) On excavation direct Labour saving =Rs. 8.28 per cyd.
- (ii) Saving in Electric charges excluding those of welding sets =Rs. 1.50 Do.
- or Rs. $9.78 \times 28.18 = 256.04$ per foot.
- (iii) Saving in direct labour charges for concreting =Rs. 14.00 per cyd. and assuming 3 cyd per foot.
 $=42.00$ per foot.

i.e. total of Rs. 298.04 per foot.

Say Rs. 298.0 per foot.

For uniformity this figure would also be for Sundarnagar Sutlej tunnel.

Considering rock conditions and the size of the tunnel, it is recommended that bonus should be made payable over a normal progress of 350 feet per month for Pandoh-Baggi Tunnel.

7. Labour strength and the categories of staff would vary from division to division and cannot be fixed. However, two broad features need to be approved by the Beas Construction Board:—

- (a) Bonus of Rs. 298.0 per foot would be payable for progress in excess of monthly progress of 300 ft. on Sundarnagar Sutlej Tunnel and 350 ft. on Pandoh Baggi Tunnel.
- (b) It would be distributed in accordance with the points fixed for each category.

When any heading becomes entitled to Bonus, the Executive Engineer, incharge would collect the figures of staff actually employed in various fields such as Electrical, Civil, Mechanical and calculate the bonus earned, total bonus points and the value of each point. He will then calculate bonus admissible to each person and prepare the rolls for both workmen and officers for payment. This expenditure would be charged to the estimate of the work. Calculations leading the value of the points and the preparation of the rolls would be submitted by him to the C.A.O. who would make payment after check.

Progress for which Bonus would right become eligible needs to take into consideration the strata, and the tunneling methods, dictated by the machinery available etc. It would therefore, be necessary to review the figures for which bonus should be granted every 1/2 yearly. Recommendations made in this Memorandum would thus be applicable from 1-1-69 to 30-6-1969.

*It was subsequently decided by the Bonus Scheme Standing Committee that Gazetted staff should not be included in the Bonus Scheme and that bonus should be payable to workcharged staff and to Sectional Officers only. In order to provide encouragement to gazetted staff in the rank of Sub-Divnl. Officers and Xens. for achieving the desired objective, they may be given a suitable honorarium as may be decided by the Standing Committee of the Beas Construction Board. on the basis of overall performance during the year.

Proposed Points Statement for Civil Staff

WORKING INSIDE THE TUNNELS DIRECTLY INVOLVED ON TUNNEL HEADINGS.	WORKING OUTSIDE THE TUNNELS BUT ASSISTING THE TUNNELLING OPERATIONS
--	---

1	No. of Workmen	Proposed Bonus points	Total	No. of Workmen	Proposed Bonus points	Total
Foreman Special	4	5	20	1	3	3
Asstt. Foreman Special	8	4	32	3	2	6
Foreman Misc., Asstt. F/Man, Asstt. Foreman Misc., Chargeman all categories	34	4	136	12	2	24
Supervisors, Works Inspectors, P.W.I., Workmisters, Store-Munshi, Store-keepers	5	2	10	6	1	6

1	2	3	4	5	6	7
Rock Drillers, Drillers, Operators Diamond Drill, Blastman, and their assistants/apprentices or juniors .	140	3	420	..	..	..
Steel Erector, Rigger, Structure Steel fitter, Fitter erection, Turner, Auto Mech., Welders, Blacksmith, M.T.O., and their assistants/apprentices or juniors .	37	2	74	21	1	21
Loco Operators, Minkey Loco Drivers, Dinkey Line Loco Drivers, Euclid Operators, Drivers, and their asstt./apprentices of juniors .	26	3	78	18	1	18
Carpenter all grades, Masons, Concrete finishers, painters, Vibrator Operators, and their asstt./apprentices or juniors .	44	2	88	19	1	19
Mixer operators, Pumpcrete Operators, Pump Drivers, and their Asstt./apprentices or juniors .	10	2	20	6	1	6
Crane/Operators all grades, Dragline Operators, T.P. Operators all grades Tractor operators, Compressor Operators, Dump man and their Asstt./apprentices or juniors .	2	..	..	8	1	8
Mate, T. M., Mate, Mucker, Skilled Workman, Gang Man, Gang Mate, Key man, Points Man, Beldars, Cleaners Clean up man .	500	1	500	240	1	240
Mucker operators of all designations including Foreman Spl. Asstt. Foreman Special, Chargeman Spl. Tractor Operators Euclid Operators, Rock Drillers .	8	4	32	..	..	..
TOTAL			1,414			351



PROPOSED POINTS STATEMENT FOR LAYOUT CREWS

Categories	Working inside the tunnels directly involved on tunnel headings		
	No. of Workmen	Proposed Bonus points	Total
Foreman Spl. Asstt. Foreman Spl: Foreman Misc., Asstt. Foreman Misc., Chargeman of all grades, Supervisor, Workmisters .	2	2	4
Surveyors	6	2	12
Beldars, Mates, T.M. Mate, Skilled Workmen	15	1	15
TOTAL			31

Inspection Crew:

Foreman Spl. Asstt. Foreman Spl. Foreman Misc. Asstt. Foreman Misc.. Supervisor, Workmisters	2	2	4
Surveyors	6	2	12
Beldars Mates, T.M. Mate, Skilled Workmen	15	1	15
TOTAL			31

PROPOSED POINTS STATEMENT FOR ELECTRICAL STAFF

WORKING INSIDE THE WORKING OUTSIDE THE
TUNNELS DIRECTLY IN- TUNNELS BUT ASSISTING
INVOLVED ON TUNNEL THE TUNNELLING OPER-
HEADINGS

1	No. of Workmen	Proposed Bonus points	Total	No. of Workmen	Proposed Bonus points	Total
2	3	4	5	6	7	
Foreman Spl.	1	5	5	2	3	6
Asstt. Foreman Spl.	1	4	4	2	2	4
Foreman Misc., Asstt. Foreman, Asstt. Foreman Misc. Chargeman of all categories	7	3	21	5	2	10
Electrician all grades, Wireman, Lineman of all grades, Welders, Fitter and their asstt./apprentices or juniors	26	2	52	10	1	10
Compressor operators and Fitters on compressors . . . . .	..	..	..	8	2	16
Beldars, T. M. Mates, Skilled Workman, Cleaners	37	1	37	21	1	21
TOTAL		119				67



PROPOSED POINTS STATEMENT FOR MECHANICAL STAFF

WORKING INSIDE THE WORKING OUTSIDE THE
TUNNELS DIRECTLY IN- TUNNELS BUT ASSISTING
INVOLVED ON TUNNEL THE TUNNELLING OPER-
HEADINGS

1	No. of Workmen	Proposed bonus points	Total	No. of workmen	Proposed bonus points	Total
2	3	4	5	6	7	
Foreman Special	3	5	15	1	3	3
Asstt. Foreman Spl.	3	4	12	2	2	4
Foreman Misc. Asstt. Foreman, Asstt. Foreman Misc. Chargeman of all categories	10	3	30	3	2	6
Mechanics of all grades, Fitters of all grades and their Asstt./Apprentices and juniors	25	3	75	8	2	16
Welders and their Asstt./Apprentices or juniors	6	2	12	10	1	10
Pump Operators of all grades, M.T. Os., Drivers Tur- ners, Blacksmith and their asstts./apprentices and juniors	20	2	40	14	1	14
Beldars, T.M. Mate, Greasers, Cleaner	55	1	55	23	1	23
TOTAL		239				76

B. *Mula Incentive Scheme*

1. *Object of the Scheme:*—This scheme envisages acceleration of production and consequent reduction in unit cost by giving incentive to the concerned staff on earthwork of Mula Dam.

2. *Scope of the Scheme:*—The scope of the scheme is for the time being restricted to the following zones of earthwork:—

- (a) Hearting zone;
- (b) Semipervious zone;
- (c) Sand zones (including sand filter).

The scheme shall be operated on experimental basis for a period of 4 months from 21-1-1971.

3. *Steps in preparing scheme:*—The following steps in preparation of the incentive scheme for earth dam construction have been considered:—

- (a) Fixing the norms of standard output of earthwork,
- (b) Evolving methods of finding out extra output,
- (c) Finding out savings accruing from the scheme,
- (d) Establishing a correlation between the incentive amount and the economy affected,
- (e) Working out equitable and just formulae for distribution of the incentive amongst the participants, and
- (f) Inserting suitable provisions for a speedy implementation of the scheme.

4. *Basis of the Scheme:*—The scheme is based on the measurement of output on each of the three zones separately for each shift of the day. The output in each shift shall be measured on the basis of No. of trips and predetermined capacity/volume capacities of the hauling units such as scrapers and dumpers. At the end of the month those figures of output shall be corrected by applying an appropriate reduction factor so as to bring the figure of total output arrived at one the trip basis in conformity with the output on the basis of monthly measurements of cross-sections of the dam.

5. *Norm of standard output:*—The standard output shall be taken for the time being as 46 and 40 brass per shift per hauling machine put on the works for scrapers and dumpers respectively regardless of the No. of hours of work done by any machine during the shift. In respect of machines in very poor condition which do not ply for more than two hours per shift, their number and output shall be excluded from the scope of this scheme. The norms of output given above may be varied at the discretion of the Superintending Engineer, Mechanical Circle (CP), Poona.

6. *Measurement of extra output:*—The extra output on any zone in a shift shall be arrived at by deducting the standard output from the actual output on that zone (arrived at after applying appropriate reduction factor as indicated in clause 4 above).

7. *Economy:*—The economy effected in respect of work on any zone in a shift shall be arrived at by the following formula:—

$$\frac{E = F \times \text{Extra output}}{\text{standard output}}$$

where

E = Economy in rupees.

F = Fixed charges of the shift calculated on the basis of method indicated in clause 8 below.

8. *Fixed charges of a shift:*—

8.1 The fixed charges of a shift for a zone shall be calculated by adding fixed charges per shift of all the earthmoving equipment and the daily emoluments of the civil supervisory staff on the field working on the concerned zone.

8.2 The fixed charges of the earthmoving equipment per shift shall be taken as equal to 50% of its plant hourly rates. If for any equipment the plant hourly rates are not prescribed, the fixed charges shall be taken as equal to the prescribed daily charges.

8.3 The fixed charges in respect of the civil supervisory staff for a shift shall be computed from the total monthly emoluments divided by 25. The monthly emoluments shall be calculated on the basis of initial starting pay in the pay-scale irrespective of the actual pay drawn.

8.4 The fixed charges shall be calculated on the basis of minimum strength of earth moving equipment and civil supervisory staff required for the job.

9. *Incentive amount:*—The total incentive amount to be distributed to the concerned staff in respect of extra output done on any zone in a shift shall not exceed one third the economy arrived at under clause 7 above subject to the proviso that it shall be further reduced suitably so as to restrict the payment to any operator in category 'A' indicated in clause 11, to a figure of Rs. 4.00 per shift. Such restrictions shall automatically cause corresponding restrictions in the incentive amounts of other categories mentioned in clause 11.

10. *Eligibility for receiving the incentive amount:—*

The following persons shall be eligible for receiving the incentive amount under this scheme.

- (i) Deputy Engineers in charge of civil earth work, and Quality Control Sub-Divisions, Civil and Mechanical Deputy Engineers working on the shifts, Mechanical Deputy Engineers in charge of heavy earth moving machinery and tractors, tankers and rollers.
- (ii) Those Civil and Mechanical Overseers, Sub-overseers, Mistries, Karkoons, Mukadams, Technical Assistants and Laboratory Assistants who conduct field supervision, Civil staff who conduct or supervise Quality Control in respect of any zone of earth work under the purview of this scheme.
- (iii) Timekeepers in charge of recording daily machinery performance and outputs even if they work in office. Drivers of inspection vehicles and pick-up vans of Deputy Engineers mentioned in (i) above and of concerned Executive Engineers.
- (iv) The Mechanical staff such as foremen, operators of heavy earthmoving machines, operators of tractors, tankers and rollers and quarry generators, senior assistant mechanics, mechanics, fitters, welders, tinsmiths, carpenters, helpers, cleaners, operators of pumps feeding overhead tanks on shift, electricians, wiremen, working in field or in repairs sections directly connected with upkeep and repairs of the heavy earthmoving machinery and tractors, tankers and rollers.
- (v) Selected Office staff members in Civil and Mechanical Sub-Divisions and Divisions as recommended by the concerned Civil or Mechanical Executive Engineer.
- (vi) Any other persons whose efforts are, in the opinion of the Superintending Engineer, Mechanical Circle (CP), Poona or Superintending Engineer, Deccan Irrigation Construction Circle No. 1, Nasik, helpful in pushing up the progress of Mula Earth work.

11. *Categories of eligible persons:—* The persons eligible to receive the incentive amount under clause 10 above shall be divided in the following three categories:—

Category 'A': (Particular category)

This shall include operators of draglines, shovels, pushers, traxcavators and hauling units such as scrapers and dumpers connected with the zones coming under the purview of this scheme as their work can be directly related to the concerned zone of work.

Category 'B': (Common Category)

This shall include all persons held eligible under clause 10 excepting (a) the Gazetted Officers, (b) persons in category 'A' above, (c) selected office staff members and (d) other persons listed at S. No. (vi) under clause 10 above.

Category 'C': (selected category)

This shall include the gazetted officers, selected office staff and other persons indicated at Sr. No. (i), (v) and (vi) above

12. *Basis of distribution of incentive amount:—*



12.1 For the purpose of distribution of the incentive amount under this scheme a relative value in terms of units of incentive amount shall be assigned to each person in categories 'A' and 'B' above on the basis of relative part played by persons in each post in increasing the output and the No. of zones from which they are eligible to draw incentive amounts.

12.2 Persons in category 'A' shall be eligible to get the incentive amount only in respect of the economy accruing from the zone on which they have worked during the shift under consideration. Persons from category 'B' shall be eligible to receive the incentive amount from any of the three zones.

12.3 The relative unit value to be given to each person in terms of the units of incentive amount shall be as given below:

	Designation	Relative value in Units
(A) <i>Particular Category</i>		
	(i) Operators of shovels, draglines, traxcavators, scrapers and dumpers	4.00
(B) <i>Common category</i>		
	(i) Overseers, Foremen, operators of dozers and heavy tractors	0.5
	(ii) Senior Asstt. Mechanics	0.4
	(iii) Technical Assistants, Sub-overseers, Electricians, Wiremen, Light Duty Operators, Drivers on Water Tankers	0.3
	(iv) Time keepers, Mistries, Karkoons, laboratory Assistants, Mechanics, Fitters, Welders, Tinsmiths, Carpenters, Operators of pumps for feeding overhead tanks during the shift	0.2
	(v) Helpers, cleaners, Mukadams, drivers of jeeps and pick ups	0.1

13. *Method of distribution of the incentive amounts:—*

13.1 The incentive amounts accruing in accordance with clause 9 shall be worked out separately for each zone during a shift

The amount for each zone shall be divided in three portions as under:—

Portion A : 20% to 28%

Portion B : 57% to 70%

Portion C : 10% to 15%

TOTAL	100%
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The exact percentage to be apportioned in a shift to each of the portion shall be at the discretion of the Executive Engineer Mechanical Division for Mula and Girna Projects, Ahmednagar.

13.2 Portion 'A' of the incentive amount shall be distributed equally amongst the operators of category 'A' who worked on the concerned zones as each operator carries the same unit value viz 4. This distribution may preferably be made at the end of the month when the reduction factors on the basis of cross-sectional measurements are known. However, the Executive Engineer, Mechanical Division for Mula and Girna Projects, Ahmednagar, may, at his discretion, make provisional payments (to be adjusted at the end of the month) by applying suitable conservative reduction factors at fortnightly or weekly intervals. It is essential to maintain for operators in category 'A', a register showing the incentive amount earned by each during each shift in a month and provisional and final payments made to him from time to time.

13.3 The incentive amounts accruing from portion 'B' in a month shall be pooled together and distributed at the end of the month amongst the persons in category 'B' in proportion to the unit value assigned to each. No person in category 'B' shall be eligible to receive the incentive amount of a month unless he has worked for at least 20 days in that month.

13.4 One fourth the amount accumulating from portion 'C' shall be kept in reserve at the disposal of the Executive Engineer Mechanical Division for Mula and Girna Projects, Ahmednagar, who may in consultation with Executive Engineer Mula Dam Division, Ahmednagar, utilise part or full of it at suitable intervals in giving token rewards to any person in Government service in appreciation of his work on Mula Dam irrespective of whether or not such person is eligible to receive incentive amount under clause 10. The token rewards can be paid in addition to the incentive amount which such person might have otherwise earned.

13.5 Three fourth of the amount accumulating from portion 'C' and the undisbursed amount if any under clause 13.4 shall be pooled together for a period four months and shall be distributed on ad-hoc basis amongst the persons listed in clause 11 under Category 'C' as per distribution to be decided by the Superintending Engineer, Mechanical Circle (CP), Poona in consultation with Superintending Engineer, Deccan Irrigation Construction Circle No. I, Nasik.

14. *Safeguards:—*

14.1 The Executive Engineer, Mechanical Division for Mula and Girna Projects, Ahmednagar, or the Executive Engineer Mula Dam Division, Ahmednagar, has the power to disqualify any operator who indulges in dangerous speeds and rough use of the machines or who neglects to comply with the instructions given to him or neglects to work on the machine to its full load and capacity. Such disqualifications may be for a period of one or more shifts or part or whole of a month.

14.2 The incentive amounts shall be proportionately reduced if the utilisation per machine shift of the hauling machines is less than 4 hours and 3½ hours respectively for scrapers and dumpers. These norms of utilisation may be varied at the discretion of the Executive Engineer, Mechanical Division for Mula and Girna Projects, Ahmednagar.

15. *Mode of payments:—*

As the incentive amounts to be distributed under this scheme arise from the saving in expenditure on works, their payments should be treated as expenditure on works and should be debited to the respective sub-heads of work. The payments shall be made by the Executive Engineer, out of his works cash on hand receipt or any such suitable form.

16. *Review of the scheme:—*

As the scheme is introduced on experimental basis, the Superintending Engineer Mechanical Circle (CP), Poona shall submit to Government reports at the end of two and four months from the commencement of the scheme making comments on the practical performance of the scheme, its effect on the output and suggestions for improvements in the scheme so as to make it fit for its general application to other major earth dam in the State.

SUPERVISORS' & EXECUTIVE TRAINING SCHEME

In relation to supervisors' training it may be programmed to train, in four sessions annually, each of ten weeks duration, 30 persons per session of the rank of Supervisors/Oversers, Assistant Engineers, Assistant Executive Engineers and Executive Engineers.

The supervisors can partly be trained on-the-job or through class-room lectures. In so far as the class-room lectures are concerned, in specific relation to the proposal for training of officers of the rank of Assistant Engineers and above, upto the Executive Engineers level, it can be suggested that such a training programme be organised under the aegis of the CW&PC at Delhi itself. A training programme could be so scheduled that the facets of equipment selection, equipment application systems of earth-moving, maintenance and preventive maintenance of such equipment, work standards and unit requirements for production and spare parts scaling respectively, inventory control, organising workshop facilities etc., etc., can be covered by lectures to be given by experienced and senior officers. Besides regular instructors to impart instructions on various facets of the subjects, officers can be drawn from the cadre of the CW&PC, the Irrigation and Power Projects, Iron Ore and Coal Mines, Specialists in the Army Headquarters, Materials Management Organisations and some of the Public Sector Undertakings or the Bureau of Public Enterprises. Reputed dealers of equipment could also be invited to give class-room lectures. Films and audio-visual means could be used for giving proper training in different facets of problems, as indicated above.

The above system of training for officers of the rank of Assistant Engineers and Executive Engineers, would bring about a tremendous change in the operation and use of equipment on construction work, or wherever the equipment is to be used.

The officers who would deliver lectures, can be drawn from a panel of names to be prepared in consultation with various other departments. Each officer may be involved for giving such lectures twice a year and with the total duration of his association with the lectures being not more than six days, each time.

In relation to supervisory staff training, persons having to be picked up from various fields of their employment, it may not be necessary to prescribe any qualifications for this purpose. It is, however, considered necessary to indicate here that it will only further the cause of development of better attitudes to work for those entering into construction industry, if the syllabi and curricula of education in the Engineering Institutes are suitably modified to include the subject of "Construction Methods and Equipment, and Fundamentals of Maintenance Engineering". The Civil Engineering and Mechanical Engineering Courses may include this subject in the third and the fourth years of education in these Engineering Institutes. This would help the Graduate Engineers turned out by these Institutes to familiarise themselves with the basic fundamentals of construction methods and the characteristics of the equipment used in construction work. They would also imbibe the basic fundamentals of Maintenance Engineering which are necessary for management and control of equipment in any field of construction work. This would further infuse a feeling of confidence in the minds of the the fresh Graduate Engineers to handle the work in construction industry.



SUGGESTIONS RECEIVED FROM UNIVERSITIES/ENGINEERING COLLEGES—ABSTRACTS OF

S. No.	Name of the College/	Present activities	Further Suggestions	Remarks received
1	2	3	4	5
1.	Regional Engineering College, Warangal.	<p>Some topics on the subject of "Construction Methods and equipment" and "Maintenance Engineering", are included in the "Electrical and Mechanical Technology" in the 3rd year of the 5 year B.E. Degree course.</p> <p>From the next academic year, 52 year B.E. (Sandwich) Course laying more emphasis on plant training is proposed to start.</p> <p>In this course a full paper on "construction equipment and methods" is included in the first semester of final year.</p>	<p>It is felt that in field like Civil Engineering, it may be possible to include "Maintenance Engineering" etc., in the curriculum and in the field of Mechanical Engineering it will not be practicable to devote time on specialised and routine maintenance problems of highly varied construction Equipment.</p> <p>The Engineering graduates who will work on maintenance of varied Construction equipment must be given a few months training on the spot before they can be finally absorbed.</p>	<p>Any change in the curriculum to be got approved by Osmania University to which the college is affiliated.</p>

1	2	3	4	5
2.	Banaras Hindu University.	A compulsory subject entitled "Construction Methods" forms a part of the curriculum of final year Civil Engineering students from 1970-71.	The fresh graduates, should be made to undergo one year's practical training in recognized and important Construction Industries using sophisticated equipment and adopting latest methods of construction. The training should be made compulsory before awarding the degree. Every important Project in the country should maintain a record of the unusual difficulties encountered in Construction and how they were overcome, the equipment and methods adopted during the execution. These records would be of immense use and value to fresh graduates.	The present practice of asking the students to undergo training on the job for a couple of months at the end of each academic year, cannot provide him with an integral picture of the project as he is not fully conversant with the fundamentals. To maintain the Construction cost at the minimum it is important to keep specialised personnel on the job.
3.	College of Engineering, Madras.	In the final year of B.E. degree course a full paper on the subject of "industrial management" has been introduced which is compulsory for all branches of students. The students are also taught the principles of Time Motion studies, planning and organising works and plant lay out, plant maintenance, routine and preventive maintenance etc.	Better teachings of these construction plants and their operations is possible only with prototype machinery and plant being made available for the study and this can best be served by organising implant training.	 नमस्कार भवन
4.	University of Roorkee.	The course "Construction and Plant" is taught in this University to the undergraduate students in the Civil Engineering Branch. A proposal to introduce "Material Handling" to the Mechanical Engineering students is under consideration. Subjects like (i) Construction Technique, (ii) Construction plant and Equipment, (iii) Planning and Operation, and (iv) Advanced Construction Technique are taught in the post graduate classes.		
5.	Sardar Vallabhai Patel Regional College of Engineering & Technology, Surat.	Emphasis is given at B.E. 4th and 5th year Civil course and exhaustive details of common type of equipment used in Civil Engineering Works are covered in the Course.	Besides the inclusion of this subject of Construction Methods and Equipment in the syllabus of under graduate student in Civil Engineering, there should be certain centres giving practical training in operation and handling of such equipment. Even a short term specialised course on "Construction Methods and Equipment" may be organised by teaching institution for practicing engineers of the locality.	
6.	College of Engineering, Poona.	This university has already made provision for three papers in Construction at the undergraduate level. Syllabus also includes subjects on Construction Method and Equipment required for deep foundation, Mechanical and Power appliances and earthmoving machinery.	It may be desirable to insist for a post graduate degree for those who are required to be in charge of major projects involving the use of various Construction Equipment.	

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As regards weightage to be given to the Construction Methods and Equipment, the college is running a post graduate Course leading to the M.E. degree in Engineering Construction and Management.

7. Birla Institute of Technology and Science, Pilani.

A practice oriented Course in Construction Planning and Equipment is offered as a compulsory subject at the second semester of the final year of the Civil Engineering, degree course.

Initially students are introduced to all aspects of Civil Engineering Construction Planning. The later part of the courses meant to introduce to students the construction practices in some major fields, such as earth moving, aggregate and concrete manufacture, under water and under-ground construction, grouting, erection of girders and highway construction. Various equipment used on those constructions and their working are presented with a specific mention about their selection, which includes cost of owning and operating such equipment, work time-studies and their renewal policies.

In general it has been observed that the students find the course quite interesting and informative.

